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ABSTRACT

Energy activities and lesson plans for grades 4, 5, and 6 (grouped into seven units representing seven major conceptual schemes) are provided in this teachers' guide, with a unit at each grade level for each conceptual scheme. Conceptual schemes addressed include: (1) energy is the ability to do work; (2) energy comes from the sun; (3) energy can be changed from one form to another; (4) the sun is the earth's chief source of radiant energy; (5) people use energy to satisfy their needs; (6) energy supplies are limited; and (7) living things are interdependent with one another and with their environment. Each unit includes a pre-/post-test evaluation instrument, lesson plans, and supplemental activities. Lesson plans consist of a specific energy concept, objective, and instructional strategies for introducing, developing, and extending the lesson. Purpose, materials, and procedures are provided for each of the supplemental student activities. The guide begins with a brief introduction to teachers and statement of the energy policy for Florida and concludes with a list of key vocabulary words (Enerwords), bibliography, sources of energy information and teaching materials, and an evaluation sheet. (JN)

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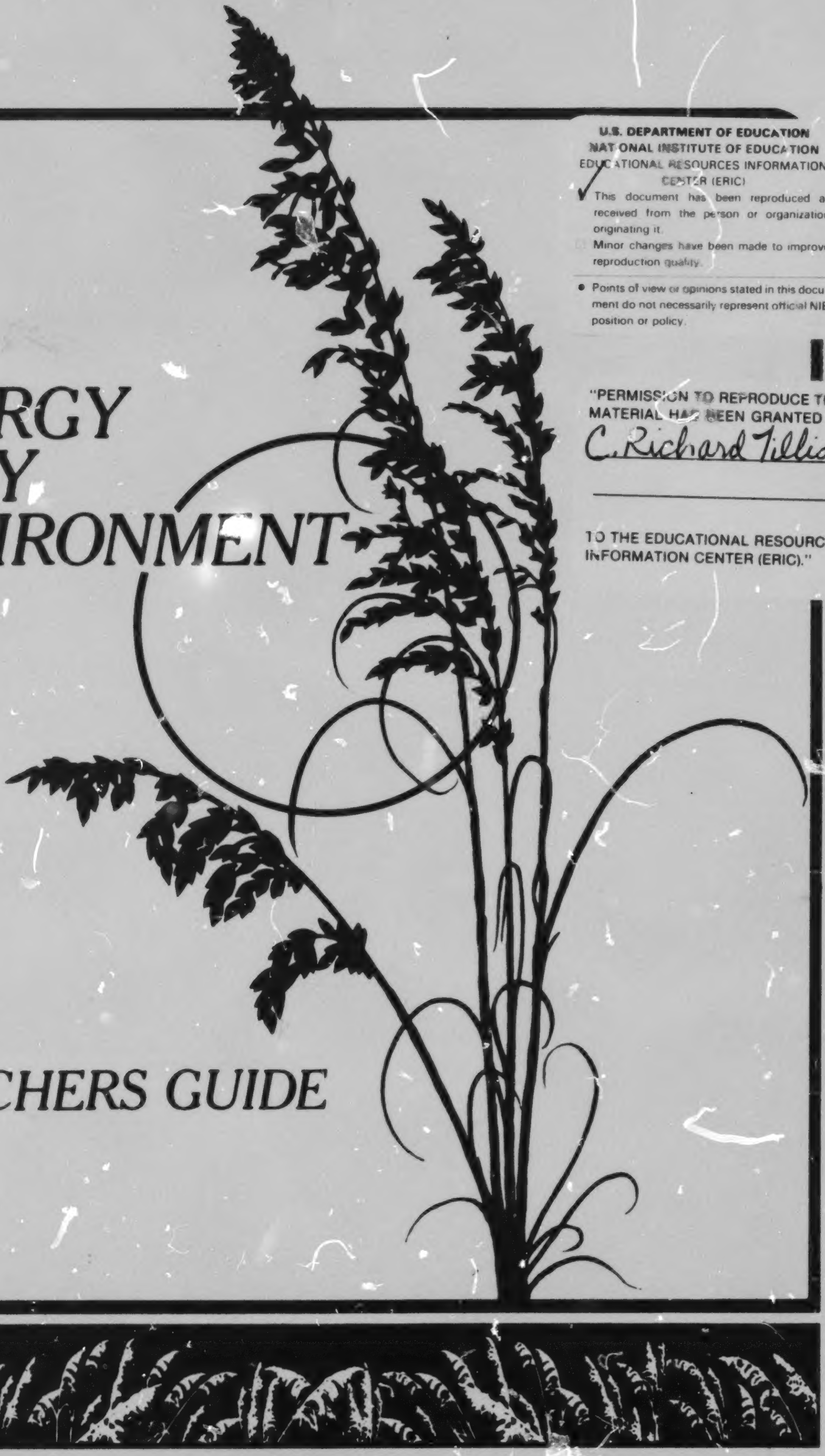

4-6
TEACHERS GUIDE

Governor's Energy Office / State of Florida

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ENERGY AND MY ENVIRONMENT

TEACHERS' GUIDE

FOR

GRADE FOUR, GRADE FIVE, GRADE SIX

Written by:
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C. Richard Tillis

June 1982

Governor's Energy Office
State of Florida

We are all parts of the great Web of Life - -
Powered by the Sun - -
All interdependent with the others.....

John H. Storer
1938

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FOREWORD

This Grade Four through Grade Six teachers' guide is the second of a series entitled ENERGY AND MY ENVIRONMENT. Other volumes of this series are:

ENERGY AND MY ENVIRONMENT, K - 3 Teachers Guide
ENERGY AND MY ENVIRONMENT, 6 - 8 Teachers Guide
ENERGY AND MY ENVIRONMENT, 9 - 10 Teachers Guide
ENERGY AND MY ENVIRONMENT, 11 - 12 Teachers Guide

After participating in many curriculum development and educational planning projects, the editors recognized one element that permeates those which were most successful. That element is the establishment of major ideas which serve as recurring themes throughout the child's educational experiences. This publication is designed to integrate key energy and energy conservation ideas in just such a manner.

The State of Florida was most fortunate to obtain the services of Dr. Matthew J. Brennan as the author of this series of teachers' guides. His work as editor on the PEOPLE AND THEIR ENVIRONMENT series established him as one of the founders and principal practitioners of this cognitive theme approach.

Through the Tri-County Teacher Education Center, Sebring, Florida, teachers were employed to select supplemental activities to accompany the lessons prepared by Dr. Brennan. Funds for this activity were provided through the mini-grant program of the Office of Energy and Environmental Education, Florida Department of Education.

These materials are designed to provide the flexibility any good teacher demands, yet provide the recurring themes which may well be essential if the lessons are to have any lasting impact on the student. These materials can play an important role in the development of a citizenry that thinks and acts on a basis of factual knowledge of key energy concepts and also possesses an understanding of the great national and international web of energy relationships and interdependencies important for the citizen of today and essential for the citizens of the future.

The editors wish to thank the dedicated educators who have contributed their time and expertise to make this series, ENERGY AND MY ENVIRONMENT, available to the teachers in Florida's schools. A special thank you goes to secretaries Edie Boynton and Patricia Patrick for the long hours spent preparing these manuscripts for printing, and to Mary Lou Stursa and Dr. Rodney Allen for their expert assistance.

The Editors

Introduction - To the Teacher

Is there an "energy crisis"? There has always been an energy crisis, as humans struggled to survive on planet earth. Now we face a new energy crisis - a crisis related to the future supply of the fossil fuels on which our civilization depends. This new energy crisis provides unlimited possibilities for student activities that will help children learn about the earth, how the use of energy has shaped civilizations of the past and present, and how it will determine the civilizations of the future.

Through their use of energy, humans have radically changed the environment. Now we must face the consequences of these changes, not only on the environment, but on all of life, including our own; on our societies; on our economies; on the air we breathe and the water we drink; on the lifestyles we lead; on the quality of the environment; and on the lives of the animals with whom we share the earth. The changes were made by people. The problems they have created can be solved only by people - indeed, by people who wish to solve them.

So we have reached the "crisis." The fossil fuels, which gave us unlimited supplies of cheap energy, are being depleted rapidly. The time for decision has arrived. How will we answer? We have the technology to solve most of the energy-related problems of the earth environment. Whether we solve these problems will depend on how clearly they are recognized and whether our values will demand their solution. It is hoped that the activities in this guide will help students to understand the scientific, social, and aesthetic alternatives that must be considered.

The activities have been organized around the seven major conceptual schemes relating to energy, with a unit at each grade level for each one of the conceptual schemes. In addition, there is a lesson concept for each lesson and supplemental activities to help the teacher coordinate the activities with other areas of the curriculum. Each lesson is designed to suggest some activity, with the emphasis on "suggest," because students and teachers will be free to interpret each activity suggestion as they will.

You will have many ideas for variation and improvement of the lessons suggested and the supplemental activities.

PLEASE RETURN THE REVIEW SHEETS LOCATED IN THE BACK OF THIS BOOK. IT IS NECESSARY THAT WE HAVE INFORMATION FROM YOU FOR EVALUATION PURPOSES.

ENERGY POLICY FOR FLORIDA

WHEREAS, energy availability strongly impacts upon every aspect of human existence and the conservation of energy resources is essential to the health, safety, and welfare of the people of this state and to the well-being of the state economy, and

WHEREAS, Florida is particularly dependent upon other states and nations to supply its energy needs, and

WHEREAS, the majority of Florida's energy requirements are obtained from petroleum and natural gas, and the supply of these fuels is subject to interruption, and

WHEREAS, wasteful, inefficient, uneconomic, and unnecessary use of energy will result in a serious depletion of energy resources and represents a potential threat to preserving the health, safety, and welfare of the people of Florida, and

WHEREAS, alternative sources of energy are years from being fully developed and there is a pressing need to accelerate research and development of these sources, and

WHEREAS, energy conservation represents a meaningful, immediate, and appropriate state response to the energy problem by eliminating waste and inefficiency and increasing economic productivity, by reducing the depletion of our domestic energy resources which, in turn, increases economic flexibility of the people of Florida, and by decreasing the pressure to develop marginally efficient methods of energy production and thereby reducing the flow of capital from the non-energy sections of the economy and avoiding serious impacts on our environment, NOW, THEREFORE, BE IT RESOLVED

IT SHALL BE THE POLICY OF THE STATE OF FLORIDA TO:

1. Develop and promote the effective use of energy in the state and discourage all forms of energy waste.
2. Play a leading role in developing and instituting energy management programs aimed at promoting energy conservation.
3. Include energy considerations in all planning.
4. Utilize and manage effectively energy resources used within state agencies.
5. Encourage local governments to include energy considerations in all planning and to support their work in promoting energy management programs.
6. Include the full participation of citizens in the development and implementation of energy programs.
7. Consider in its decisions the energy needs of each economic sector, including residential, industrial, commercial, agricultural and governmental uses.

8. Promote energy education and the public dissemination of information on energy and its environmental, economic and social impact.

9. Encourage the research, development, demonstration, and application of alternative energy resources, particularly renewable energy resources.

10. Consider in its decision making the social, economic and environmental impacts of energy-related activities, so that detrimental effects of these activities are understood and minimized.

11. Develop and maintain energy emergency preparedness plans to minimize the effects within Florida of an energy shortage.

(Chapter 377.601, Florida Statutes)

GRADE FOUR

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ENERGY TEST

A Pre-test AND Post-test Evaluation Instrument

Grade 4

1. List the three forms of matter. (gas, liquid, solid)

2. What is a fossil fuel? (energy stored ages ago in the body of a living thing -- coal, oil, natural gas)

3. In terms of energy, what is the difference between a food and a fuel? (none)

4. List 3 animal foods used as fuels by people. (wood, grass, plant oils, animal oils, wax)

5. List 3 ways people get rid of excess waste heat from energy use. (automobile fan, exhaust fan, electric power plant cooling tower)

6. What is the name for the material used to keep heat from being lost to to the air? (insulation)

7. List 3 ways that animals use solar energy. (sunbaths, eggs in hot sand or leaves, eat plants)

8. What is an appliance? (a machine that uses electricity to do people's work)

9. What is the difference between a "need" and a "want"? (need is essential for survival)

10. How can a body run out of energy? (not enough food or rest, not enough oxygen to burn food in body)

11. Match the food and the plant part in which it is stored.

a.	leaf	- (4)		1.	carrot
b.	bud	- (6)		2.	maple syrup
c.	stem	- (7)		3.	broccoli
d.	root	- (1)		4.	lettuce
e.	flower	- (3)		5.	orange
f.	seed	- (8)		6.	asparagus
g.	fruit	- (5)		7.	celery
h.	sap	- (2)		8.	peas

12. Match the plant part with the animal that eats it to get energy.

a.	leaf	- (7)		1.	beaver
b.	bud	- (4)		2.	mouse
c.	stem	- (8)		3.	insect
d.	bark	- (1)		4.	deer
e.	root	- (9)		5.	raccoon
f.	flower	- (3)		6.	sapsucker
g.	seed	- (2)		7.	rabbit
h.	fruit	- (5)		8.	beetle
i.	sap	- (6)		9.	nematode

13. What kind of energy is used to start a car? (electric energy stored in the battery)

14. How do people get energy from falling water? (run water through a turbine which turns a generator)

15. List three ways to save energy in heating a house. (lower the thermostat, insulation, storm windows or double glass)

Title: Energy In My Life

Concept: Energy is the ability to do work.

Objective: To give children the opportunity to discover the relationships between their use of energy and their movements, growth and comfort

Introducing the lesson:

1. Ask the children to keep a food diary and an energy use record for a week and the purposes for which the energy was used. (It is not necessary to count calories in foods or units of fuel. However, it will be a more complete record if they record: "1 hamburger, small fries, glass of milk" rather than "lunch.")

2. Have each student make a summary of each kind of energy used. (food, beverages, electric appliances, heating or cooling, lighting, radio, TV, automobile miles (gallons of gas), transportation, etc.)

Developing the lesson:

1. Make a class summary for each use.

2. Estimate energy use for the school. (Class use X number of classes - or use class as percentage of school population)

3. Identify big "energy spenders," small "spenders."

4. Go through the class lists and identify energy used for needs, wants, and luxuries.

Extending the lesson:

1. Record number of times refrigerator doors were opened by members of the class for a week!

2. Identify instances of energy waste.

3. Plan a program to cut down energy waste.

4. Compare energy use by the class with a class of twenty years ago; fifty years ago.

5. Start a class energy vocabulary - words relating to energy that are used in the lesson.

Title: "ENERWORDS"

Concept: Energy is the ability to do work.

Objective: To develop a vocabulary of energy-related words

Introducing the lesson:

1. Ask the children to save newspapers for a week, or until you have collected enough papers so that each child has a paper.
2. Hand out the papers, asking the children to circle all the words relating to energy -- the "ENERWORDS."

Developing the lesson:

1. Keep a record of the number of "enerwords" used during the week.
2. Make a list of the topics covered in the news stories.
3. Investigate each section of the papers to determine which has more information about the use of energy to do work, move things, make things grow, heat and cool, etc. (business, general, local news, food, sports sections)

Extending the lesson:

1. Go to the newspaper office with the class and compare the number of "enerwords" with the papers for the same date one year ago; ten years ago.
2. Check some earlier papers.
3. Find a cartoon that uses an "enerword" as its subject or to tell its story.
4. Have the children invent new "enerwords" using combinations of words from their lists of "enerwords."
5. Write a story describing the world ten years from now using their new "enerwords."
6. Have the children tell their story to the class.
7. Start a list of class "enerwords" using the "enerwords" found in the papers that relate to their own use of energy.

Title: Stored Energy

Concept: There are many forms of energy.

Objective: To discover the relationship between matter and the energy that may be stored in it

Introducing the lesson:

1. Blow up a balloon. Let it go and watch it jet around the room.
2. Ask: Was there energy stored in the hot air of the balloon before I let it go?
3. Ask: What other kinds of matter have stored energy in them? (foods, fuel)

Developing the lesson:

1. Make a list of the kinds of matter that the children suggest.
2. Ask the children to divide the items on their list into three forms of matter -- solid, liquid, or gas.
3. Now make a list for each. (gas -- natural gas, hydrogen, oxygen, steam; liquid -- liquified gases, oils; solid -- coal, wood, uranium, candle, battery)

Extending the lesson:

1. Ask: What is a fossil fuel? (stored energy in a fossil - a once living thing that has been buried in the earth)
2. Investigate the formation of fossil fuels - coal, oil, and gas.
3. Investigate the energy value of various fossil fuels.
4. Draw a picture of a stored energy being used.
5. Tell the story of your picture.
6. Add to the class "enerword" list.

Title: Food - Or - Fuel?

Concept: Organic matter contains stored energy.

Objective: To recognize the relationships between foods and fuels and the living things that use them to supply energy

Introducing the lesson:

1. Fill a pyrex test tube half full of cold water. Have a student hold half of an English walnut on the end of a piece of insulated wire, or on a wooden-handled needle.

2. Hold, with tongs, the test tube over a sand-filled pie plate. Light the walnut with a match and hold the burning walnut under the test tube.

3. When the water starts to boil ask: Is the walnut we are using here a food or a fuel? (A fuel -- man is the only living thing that uses fire. Other living things would use the walnut only as food. Man also uses walnuts as food.)

Developing the lesson:

1. Ask: What happened to the walnut? (It was burned up.)

2. Ask: Why did I burn the walnut? (to release its energy as heat and light)

3. Discuss the similarity between what happens to the walnut as fuel (it combines with oxygen to release energy as heat and light) and as food (it combines with the oxygen we breathe to release energy for growth and heat to keep the body warm). In both cases, the stored energy is "burned up."

Extending the lesson:

1. Ask: What is the difference between a food and a fuel in terms of energy? (none)

2. Investigate fuels humans cannot use as foods. (Man cannot digest oil, coal, and wood.)

3. Ask: How would your view of a walnut differ from a squirrel's view? (The squirrel would not use it as a fuel for a fire -- only as a fuel for its body or food.)

4. Ask the students to make a list of animal foods used as fuel by humans. (wood, grass, oil from plants and animals)

5. Add to the class energy word list -- "ENERWORDS."

Materials: walnut, tongs, needle, test tube, sand-filled pie plate to use as base during burning, matches

GRADE 4, UNIT III, LESSON 1

Title: Change Energy To Move Something

Concept: Energy can be changed from one form to another.

Objective: To discover the relationships among the various forms of energy

Introducing the lesson:

1. Ask the children to use some energy to move something. (Do not help them or comment on what they are doing until they have all moved something.)
2. Make a list of the things moved by the children.

Developing the lesson:

1. Divide the listed activities into categories. (body movements, fans, push, pull, lift, drive, etc.)
2. For each type of movement, discuss what kind of energy was used and how it was changed to make something move. (food for movement or to do work, fan to blow paper, electricity to move fan, etc.)
3. Ask: How was energy lost in each activity? (Heat is given off and lost.)

Extending the lesson:

1. Create a movement which shows energy that is not body energy being used. (wind, light, heat)
2. Draw a picture of yourself changing energy to move something.
3. Explain your picture.
4. Write a sentence describing an energy change.
5. Add to the class energy word list -- "ENERWORDS."

Title: Lost Heat

Concept: Energy loss can be reduced by using insulation.

Objective: To discover the relationship between energy loss and insulation

Introducing the lesson:

1. Take the class on a survey tour of the school to find examples of heat or air conditioning energy being lost. (Do not help the students or make any suggestions.)
2. Ask each student to quietly make a list of the examples found.

Developing the lesson:

1. Make a class list of examples of heat energy loss. (This should include loss of heat through windows, doors, uninsulated pipes, hot water use and waste.)
2. For each item on the class list, have the students suggest how the waste could be eliminated or reduced. (by insulating, caulking, etc.)
3. Now take the class outside and look for more examples of heat energy being lost or wasted.
4. Ask: How could the lost energy be restored? (It cannot. Heat energy lost is gone forever.)

Extending the lesson:

1. Find examples of efforts to get rid of heat energy. (fan to cool auto engines; cooling tower in electric power plant; exhaust fan in kitchen, etc.)
2. Draw a picture of heat energy being lost.
3. Describe your picture.
4. Evaluation: Use the word "insulation" in a sentence or short story.
5. Add to the class energy word list -- "ENERWORDS."

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Title: Animals Use Solar Energy

Concept: The sun is a source of (heat) energy.

Objective: To discover the relationship between animal life and the sun's energy

Introducing the lesson:

1. On a bright sunny day, take the class outdoors to look for examples of how living things use solar energy directly. (Do not help the students or make suggestions.)
2. Have each student make a list of the examples found.

Developing the lesson:

1. Make a class list of the examples of direct use of solar energy observed. (The list should include uses of sunlight - to see, help green leaves make food, etc; and sun heat - to warm bodies, etc.)
2. Ask: How has nature designed living things to collect solar energy? (leaves broad and flat; tree branches spread out; animals with darker color on top; water animals, turtles and snakes designed to crawl on logs for sunbaths, etc.)
3. Draw a picture showing how man has designed things to use solar energy directly.
4. Describe your picture.

Extending the lesson:

1. Investigate how cold-blooded animals use solar energy in reproduction. (Snake and turtle eggs are laid in sand, which is warmed by sun. Alligators lay their eggs and cover them with piles of grasses and mud. The heat from the sun speeds up the decay of the grasses and produces heat to incubate their eggs.)
2. Use some art form to describe an animal's use of solar energy.
3. Ask: How are people like other animals in their use of solar energy? (sunbath, etc.)
4. Investigate the dangers to the eyes and skin from too much solar energy. (sunburn, cancer, blindness)
5. Add to the class energy word list -- "ENERWORDS."

Title: A Sun Dance

Concept: The sun is a source of energy.

Objective: To give children the opportunity to express their feelings about the sun's energy

Introducing the lesson:

1. Take the class outdoors to the playground. Ask them to just relax in the sun in any way they wish -- sitting, standing, walking, running -- but without communication with another.
2. After about 10 or 15 minutes, ask them to invent a movement which seems to express a feeling about the sun's energy.

Developing the lesson:

1. After everyone (who wishes to) has found a movement which expresses a feeling about solar energy, ask individuals to show their movement to the class.
2. Ask the class to guess what feeling is being expressed; then have the demonstrator identify the feeling expressed in the movement.
3. If there is a movement which many seem to like, have the "inventor" of the movement teach it to the others.
4. They have created a solar-energy dance.

Extending the lesson:

1. Have the students describe the feeling they expressed by movement with words.
2. Discuss with the class why it is sometimes easier to express a feeling by a movement instead of words.
3. Extend the dance by combining two or more of the individual movements.
4. Try to find some music that fits the dance.
5. Ask: Where did the energy to do the solar-energy dance (or movement) come from? (the sun, by way of our food and green plants)
6. Add to the class energy word list -- "ENERWORDS."

Title: Appliances In My Home

Concept: People use energy in appliances to do their work.

Objective: To give children the opportunity to discover the relationship between their lifestyles and their use of energy for appliances

Introducing the lesson:

1. Have each student make an inventory list of all electric appliances in their home.
2. For a week, have them keep a record on their inventory list of the electric appliances used, for what use, and for how long. (i.e.-- toaster, to toast bread, 2 minutes)

Developing the lesson:

1. Make a class list of appliances and the length of time and number of times each is used.
2. Put a mark beside each appliance that was used by all members of the class. Ask: Does this mean that these appliances are needed? (perhaps; or only that they are very popular)
3. Total the time of use by the class for each appliance and rank them according to the amount of use.
4. Discuss those uses students could or would do without to conserve energy.

Extending the lesson:

1. Ask each student to list the three appliances on the list that they would keep if they could have only three. (values)
2. Ask: Does our number one rating for our most used appliance mean that it is "needed"? (discuss)
3. Compare the class list of appliances with one for another culture - Eskimo, Indian, Chinese.
4. Do the same for an earlier generation.
5. Draw a picture of yourself using your favorite appliance.
6. Add to the class energy word list -- "ENERWORDS."

Title: "Wants" Become "Needs"

Concept: People use energy to satisfy their needs.

Objective: To give children the opportunity to examine and evaluate their use of energy

Introducing the lesson:

This lesson should follow the preceeding lesson on the use of electric appliances. Lesson 1 serves as an introduction to this lesson.

Developing the lesson:

1. Now that you have done an inventory of your use of electric appliances, during the week keep a record of your use of all kinds of energy. (food, fuel, transportation, recreation, work, etc.)
2. Make a class list of kinds of energy used, purpose for which energy was used, and for how long energy was used.
3. Rank the uses of energy from "most used" to "least used."
4. Ask: Is there another way to rank our use of energy? (cost, scarcity, need, etc.)

Extending the lesson:

1. Go through the purposes for which energy was used and evaluate them as "necessary," or "could do without."
2. Ask: How many of the uses listed under "could do without" could or would you (the members of the class) be willing to do without to conserve energy?
3. Discuss the differences between "needs" and "wants."
4. Ask: When does a "want" become a "need"?
5. Draw a picture of yourself in a world with all the energy you wanted.
6. Add to the class energy word list -- "ENERWORDS."

Title: A Picture Of Energy Being Saved

Concept: Energy supplies can be saved.

Objective: To give children the opportunity to discover ways to save energy

Introducing the lesson:

Ask the students to draw a picture of energy being saved. (Do not help or suggest in any way.)

Developing the lesson:

1. Ask the students to identify the energy-saving (conservation) methods suggested in each picture.
2. During the discussion, ask for suggestions for other or better ways to conserve energy.
3. Try them out!

Extending the lesson:

1. Design a sign urging the public to conserve energy.
2. Make the best sign (by class vote) into a public service advertisement.
3. Get your local newspaper or TV station to show your advertisement.
4. Design an energy conservation plan for your school.
5. Get your principal to implement your plan.
6. Many small car owners are showing bumper stickers which say: "I'm saving gas." Ask the students to discuss this bumper sticker's message. (Pro -- "They are certainly using less gas than if they were driving a bigger car." Con -- "Can you save gas while using it?" or "Is the owner of a private jet airplane conserving gas when he uses a large luxury car instead?")
7. Prepare "spot" energy announcements for use over the school's P.A. system.
8. Add to the class energy word list -- "ENERWORDS."

Title: Is There An Energy "Crisis"?

Concept: Energy supplies are limited.

Objective: To evaluate the energy "crisis" in terms of supply, demand, cost

Introducing the lesson:

1. Ask the students to bring in advertisements that seem to encourage greater use of energy. (for one week)

2. Without comment, place them on the bulletin board.

3. During the week, have the students investigate the events of the oil embargo of 1973 and the resulting energy "crisis."

    a. causes (Mid-east war)
    b. effects (gasoline shortages, increased prices)
    c. reaction of society in the U.S. (hoarding)

Developing the lesson:

1. Calculate the amount of gasoline that could be "hoarded" if each car's tank was filled by an anxious (and selfish) owner. (15 gallons x 8 to 10 million cars)

2. Discuss the reactions of "hoarders."

3. Look for evidence that people are aware of the energy "crisis" in school (Is there a conservation plan?), home (Is there a conservation plan?), community, state, nation.

4. Look for evidence to the contrary. Are sales of big cars increasing? Are motorized boat sales up?

Extending the lesson:

1. Look for changes in industry advertisements as a result of the energy "crisis." (mention of lower energy use - "efficiency"; do-it-yourself ads; an oil that saves gasoline)

    a. changing energy supplies (switch to gas or coal)
    b. changing demands of people (look for low-energy ads; solar, etc.)

2. Draw a picture of yourself in an energy "crisis." (car out of gas)

3. Design a picture of yourself using an alternative energy source. (bicycle passing a stalled car)

4. Add to the class energy word list -- "ENERWORDS."

GRADE 4, UNIT VI, LESSON 2

Title: Running Out Of Body Energy

Concept: Energy supplies are limited.

Objective: To discover that humans also can have an energy "crisis"

Introducing the lesson:

1. At the beginning of this lesson, say: I think I have run out of body energy.
2. Ask: Is there anyone else in the class who has run out of body energy?
3. Ask: How can a body run out of energy or be tired? (not enough food; not enough oxygen to "burn" the food and release energy; not enough rest to restore muscle energy)

Developing the lesson:

1. Ask the students to look in periodicals, magazines, and papers for stories and pictures of people running out of body energy. (Do not help! Pictures should include workers, athletes, mountain climbers, children playing.)
2. Group the pictures according to type of activity.
3. Investigate feelings of mountain climbers running out of energy.
    a. How did they restore their energy supplies?
    b. How much weight did they lose?

Extending the lesson:

1. Have the students make an historical record of climbs on Mount Everest, Mount McKinley (Denali), the Matterhorn, and the Eiger.
2. Ask: Why is oxygen used? (to speed up oxidation, "burning" energy supplies; or at high altitudes where oxygen supplies are limited, to make sufficient oxygen available)
3. Investigate the problems of keeping up body temperatures in the Antarctic.
4. Draw a picture of yourself running out of energy.
5. Add to the class energy word list -- "ENERWORDS."

Title: Plants Store Energy

Concept: Living things are interdependent with their environment.

Objective: To discover the relationship between animal food and plant energy storage

Introducing the lesson:

Ask the students to list all the plant parts they have eaten during the past week. (They should mention every part.)

Developing the lesson:

1. Find an animal that uses each of the plant parts listed by the class
   a. leaves - (lettuce) - rabbits, insects
   b. buds - (asparagus) - deer, grouse, squirrels
   c. stem - (celery) - insects
   d. bark - beaver
   e. root - (carrot) - horses, nematodes
   f. flower - (cauliflower, broccoli) - insects
   g. seed - (peas, beans, peanuts) - birds, mice
   h. fruit - (oranges, apples) - birds, mammals
   i. sap - (maple syrup) - sapsucker
2. Find an animal that eats all parts except bark. (human, raccoon)

Extending the lesson:

1. Find a plant that does not store energy. (nongreen plants - fungi)
2. Have the students plan a "vegetarian" menu that uses every plant part (except bark).
3. Draw a picture of a vegetarian. (man or other animal)
4. Add to the class energy word list -- "ENERWORDS."

Title: Energy Use Affects My Environment

Concept: Energy use affects everyone.

Objective: To give children the opportunity to discover the relationship between energy use and environmental effect and their feelings about it

Introducing the lesson:

1. Ask the students to draw a picture showing how their own use of energy affects their environment.
2. Have students describe their pictures.

Developing the lesson:

1. Using the class pictures and descriptions, make a list of the uses of energy by the class and the environmental effects of that use. (car - air pollution; electricity - nuclear waste, thermal heating and cooling, strip mining, etc.)
2. Draw a picture showing environmental effects of energy use by you in your home.
3. Draw a picture showing environmental effects of energy use by you at school.
4. Draw a picture showing environmental effects of energy use by you on vacation.

Extending the lesson:

1. Describe your pictures.
2. For each effect on you or your environment, discuss how it can be eliminated or lessened.
3. Ask: What is the environmental effect of littering? (waste of materials and the energy to replace them; aesthetic effect; cost of clean-up, etc.)
4. Find something about energy use that makes you feel:
    - a. good
    - b. bad
    - c. terribly upset
    - d. who cares?
5. Draw a picture or cartoon showing how you feel.
6. Describe your picture.
7. Add to the class energy word list -- "ENERWORDS."

GRADE FIVE

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ENERGY TEST

A Pre-test And Post-test Evaluation Instrument

Grade 5

1. List 5 categories of energy use in providing a product. (production, packaging, transportation, marketing, use, disposal)

2. What must we do to make things move faster? (use more energy)

3. Why do smooth roads and radial tires increase car mileage per gallon of gas used? (less loss of energy from friction)

4. Give five words to describe energy we "sense."

   a. sight - ________, ________, ________, ________, ________
   b. sound - ________, ________, ________, ________, ________
   c. smell - ________, ________, ________, ________, ________
   d. touch - ________, ________, ________, ________, ________
   e. taste - ________, ________, ________, ________, ________

5. List five endangered forms of wildlife in Florida. (Everglades kite, panther, manatee, Cape Sabal sparrow, sandhill crane)

6. Why are endangered species "endangered?" (motorboats, loss of food energy sources, and/or habitat)

7. What is the source of energy in a burning candle? (plant oils and wax)

8. List three sources of energy that are not fossil or solar. (nuclear, geothermal, water power)

9. Is Florida an energy producing state? (yes)

10. Does Florida produce as much energy as it uses? (no)

11. Match the sources and uses of energy.

a.	reservoir	-	(5)	1.	drive an automobile
b.	battery	-	(4)	2.	move a body
c.	food	-	(2)	3.	run an appliance
d.	fuel	-	(1)	4.	start an automobile
e.	electricity	-	(3)	5.	drive a generator

12. List five places in your community that you would have to visit in order to study energy supplies. (electric power plant, coal yard, natural gas distributor, gasoline station, firewood dealer, oil depot, food store)

13. How is energy use related to people's lifestyles? (People with a high standard of living use much more energy and people with low incomes often live in energy-wasting homes.)

14. Why is the wind an undependable energy source? (It doesn't blow all the time, or at the same speed.)

15. Match the energy source with the method used to get it.

a. coal - (4)
b. nuclear - (5)
c. oil - (1)
d. peat - (2)
e. wood - (6)
f. electricity - (3)

1. drilling
2. digging
3. generator
4. strip mining
5. fission
6. sawing

GRADE 5, UNIT I, LESSON 1

Title: Energy In My Environment

Concept: Energy is used to do work.

Objective: To give children the opportunity to discover energy being used in their environment to do work -- to move things, heat things, make things

Introducing the lesson:

Ask the students to make a list of ten objects in their environment which they use or observe regularly. They may want to go out on the school grounds, but they should be able to make their list from memory. "In their environment" means something that affects their lives in some way.

Developing the lesson:

1. For each item on their list, ask the students to investigate what kind and how much energy is used to make it. (answer may involve energy used in production, packaging, delivery, etc.)
2. For each item, ask the students to suggest an alternative that requires less energy.
3. Now investigate the energy required to use each item on the list.
4. Suggest alternatives that require less energy for their use. (a bicycle instead of car for transportation; a hand toothbrush; a towel to dry hair)

Extending the lesson:

1. Make a class list from the student lists.
2. Identify the ten objects listed most often and indicate whether they are high energy users or low energy users.
3. Ask: Is body power always a good substitute for energy being used? (In our society, there are many things that we can no longer do with body power - grow our food, etc.)
5. Draw a picture of yourself with your ten "things."
6. Describe your "environment" in terms of energy use.
7. Create a dance or find pictures of dancers that illustrate five kinds of energy.
8. Collect music that says something about energy.
9. Start a class energy word list -- a vocabularly of "ENERWORDS."

Title: Making Things Move Faster

Concept: Energy is used to do work.

Objective: To discover the relationship between amounts of work done and energy used (More energy is required to do more work.)

Introducing the lesson:

1. Take the class outside the school. Ask a volunteer or two (boy and girl) to bring their bicycles to the study area.
2. Ask the students to ride very slowly around the campus in front of the class, using both sidewalk and lawn or unpaved area.
3. Have the other students check the riders' appearance when they return. (hot, out of breath, etc.)

Developing the lesson:

1. If the bicycle owners are willing, let other students ride the "course," at first slowly, then very fast.
2. Ask the students to compare the appearance of the riders going slowly with that of the riders going fast. (There will be considerable differences in breathing rates and expressions of "tired," "out of breath," etc.)
3. Ask: What do we have to do to move things faster? (use more energy)
4. Now look for twenty things being moved and discuss how each could be made to move more rapidly.
5. Ask: Was there any difference in the amount of energy used in riding on the pavement and on the rough surface? (Roads are paved to reduce friction as well as to provide a smoother ride.)

Extending the lesson:

1. Ask the students to move something without using any energy. (They cannot.)
2. Investigate whether energy is needed to make something stop moving. (Try to stop the bicycle from behind, not from the front.)
3. Ask the students to sit for a few minutes and not use energy. (They will find it impossible. Some energy use in their bodies is not under their control.)
4. Draw a picture of yourself trying to do nothing.
5. Describe yourself doing nothing.
6. Add to the class energy word list -- "ENERWORDS."

Title: Energy Flow In My School

Concept: Energy comes in many forms.

Objective: To give students the opportunity to discover the relationship between energy supply and energy use in their school

Introducing the lesson:

1. Take the class on a tour of the school grounds; observe the service area where the utility lines enter the buildings, and where oil or gas is stored.

2. Make a small map of the campus showing the flow of energy into the school.

Developing the lesson:

1. Paste your school energy flow map in the middle of a large piece of paper or on the chalkboard.

2. Add the facilities, structures, etc., that are necessary to get the energy from its source to the school. (water, oil, gas, electricity.) This should include the local power plant and the source of the fuel used to run it.

Extending the lesson:

1. Discuss the energy flow out of your school. Ask: What energy leaves the school? (heat, light, and, most important, brain energy and its products - information and knowledge)

2. Ask: Do we get a greater energy return from the money spent for utilities or instruction?

3. Discuss the brain energy flow.

4. Draw a picture of the brain energy flow into and out of the school.

5. Design an energy conservation plan to reduce the flow of energy into the school.

6. Put it into effect!

7. Add to the class "ENERWORD" list.

GRADE 5, UNIT II, LESSON 2

Title: Make a "Sense Chart"

Concept: Environments are in constant change.

Objective: To give students the opportunity to discover their awareness of energy in their environment

Introducing the lesson:

1. Ask the students to give an immediate response with an "ENERWORD" they think of when you say a word. Ask one student to record the "ENERWORDS."

2. In rapid order, or as quickly as you get a response, say:

   a. "sight" - (smoke, light, traffic, movement, etc.)
   b. "sound" - (motor, wind, traffic, movement, etc.
   c. "smell" - (cooking, toast, burning, smoke, candy, etc.)
   d. "touch" - (wood, coal, hot, cold, oil, food, etc.)
   e. "taste" - (candy, oil, nut, sweet, sour, etc.)

4. Repeat the list of the five principal senses until you have a good list of "ENERWORDS" that relate to the senses.

Developing the lesson:

1. Make a class list of "ENERWORDS" that were suggested for each of these senses.

2. Have each student make a visual chart of how all their senses interact with energy.

3. Have the students describe their chart.

Extending the lesson:

1. Find the energy words that were suggested by more than one of the senses.

2. Find the energy words that were suggested by all of the senses. (food cooking)

3. Design another "sense chart" showing yourself reacting to some energy source in your environment.

4. Now do the same for an energy use.

5. Describe your "sense charts."

6. Add to the class energy word list.

Title: A Food Energy Chain

Concept: Energy can be changed from one form to another.

Objective: To discover the relationship between food energy and the living things that use it to move, grow, and reproduce

Introducing the lesson:

1. On the chalkboard, put a list of the food items in a typical breakfast - ham and eggs, toast, juice and milk or coffee.
2. Ask the students to trace the energy in their breakfast back to the sun, listing each living thing through which it passed on its way to the breakfast table.
3. Say: This is a food energy chain.

Developing the lesson:

1. Call the roll and ask each student to name a wild animal as their name is called.
2. Ask the students to develop a food energy chain for the wild animal they name. (Some will eat green plants directly: squirrel - acorn -oak tree - sun; others, which eat other animals, will have longer food energy chains: owl - squirrel - acorn - oak tree - sun)
3. Have the students identify a wild animal with the longest food energy chain. (a predator, i.e., the panther: panther - otter - fish - worm - soil fungus - green plant - sun.)

Extending the lesson:

1 Develop a food energy chain that starts with:
   a. a cereal
   b. a water plant
   c. a tree
2. Investigate the "endangered species" of wildlife that live in your area. (panther, Everglades kite, crocodile, manatee, etc.)
3. Ask: Why are these animals in danger of extinction? (loss of land area, food energy sources, shelter, poisons)
4. Ask: Is there any relationship between energy transfer in food energy chains and pesticide transfer? (Yes. Pesticide residues on plants are transferred to the animals that eat them as food, and are concentrated in the animals at the top of the food energy chain - birds, fish, man and other mammals.)

5. Draw a picture of yourself as a link in your favorite food energy chain.
6. Let the class guess the favorite foods of each class member from the pictures.
7. Compare the food energy use of people who mostly eat cereals with those who eat large amounts of meat.
8. Add to the class energy word list.

Title: People Store Energy

Concept: Some forms of energy can be stored for later use.

Objective: To discover the relationship between energy forms and energy storage by people

Introducing the lesson:

1. Light a candle.
2. Let it burn for awhile, until the burning has stimulated several of the senses.
3. Ask one of the students to investigate whether or not heat energy is being given off.
4. Ask: What is the source of the heat and light energy in the candle? (wax - stored plant oils)

Developing the lesson:

1. Find evidence of stored energy in the classroom, school building, and on the school grounds. (food, batteries, water pressure, candles, seeds, fuel tanks, etc.)
2. Go out and find people storing energy.
3. Make a list of what you found.
4. Investigate how people use stored energy as power.

Extending the lesson:

1. Prove that there is energy stored in:
    a. the water behind a dam. (Build one!)
    b. a battery. (Light a flashlight. Start a motor.)
    c. food. (Burn it.)
    d. a fuel. (Burn it.)
2. Find out how other animals store energy.
3. Investigate how plants store energy. (as fat oils, carbohydrates, and proteins stored in the part of the plant people use as food)
4. Draw a picture of stored energy being used:
    a. to make electricity. (coal, oil, water power)
    b. to move something. (water wheel)
5. Add to the class energy word list.

Title: The Sun's Energy Affects People

Concept: The sun supplies most of the earth's radiant energy.

Objective: To discover the relationship between solar energy and the life-styles of people

Introducing the lesson:

1. Write on the chalkboard: The sun supplies most of the earth's radiant energy.
2. Ask the students to write out their reasons why they agree or disagree with the statement.

Developing the lesson:

1. Discuss with the students their reasons for agreement with the statement. (All stored food energy, wood, and forage is stored by green plants using solar energy directly. All of our fossil fuels were stored by green plants and animals who ate green plants living ages ago and are now buried in the earth's rocks, so they are indirect supplies of solar energy - for example, coal, natural gas, and oil.)
2. Discuss reasons for disagreement. (Large amounts of water power, nuclear power, and geothermal power from the hot interior of the earth are not solar energy.)
3. Ask the students to list the sources of energy that are not solar. (nuclear, geothermal, water power)
4. Ask: How about wind power? (Wind is air moving because of uneven heating by the sun over different parts of the earth.)

Extending the lesson:

1. Investigate the major ocean currents.
    a. warm - moving from the equator
    b. cold - moving from the poles
    c. both resulting from uneven solar heating over different parts of the earth
2. Draw a picture of yourself or a friend enjoying some solar energy:
    a. directly. (sunbathing)
    b. indirectly. (sailing)
3. Investigate the reasons why people do not use more direct solar energy instead of scarce and costly fossil fuels. (Until very recently, fossil fuels were cheap and in good supply. In the future, more and more solar energy will be used.)
4. Add to the class energy word list.

GRADE 5, UNIT IV, LESSON 2

Title: Green Plants Use the Sun's Energy

Concept: Green plants use solar energy to make food.

Objective: To discover the relationship between the green plants, the sun and the earth's food supply

Introducing the lesson:

Ask the students to design an investigation to show that green plants use solar energy to make food. (Refer to your science text.)

Developing the lesson:

1. Carry out the student investigations. (Be prepared with a few packets of vegetable seeds and some pots.)
2. Design an investigation that can be done with a plant growing on the school grounds.
3. Find a way to help your green plants make and store food energy. (mini-greenhouse)
4. Try to grow a green plant in the dark.
5. Ask: How can mushrooms grow in the dark? (They live on dead remains of former green plants.)

Extending the lesson:

1. Investigate the needs of green plants for direct sunlight. (Compare plants in sunny and shady areas.)
2. Have the students tell the story of their experimental green plant and solar energy.
3. Investigate the needs of plants for water. (used to make food when combined with carbon dioxide, using the sun's energy)
4. Draw a picture of a world without green plants.
5. Describe your picture to the rest of the class.
6. Add to the class energy word list.

Title: My "Dream World"

Concept: People use energy to satisfy their needs and "wants."

Objective: To discover the relationship:

- a. between energy use and people's needs and "wants"
- b. between a "dream world" and high energy use

Introducing the lesson:

1. Ask the students to draw a picture of themselves in their "dream world."
2. Play a recording of "The Big Rock Candy Mountain."

Developing the lesson:

1. Have the students describe their "dream world" as shown in their pictures.
2. List the items shown in the "dream worlds" of the class.
3. Have the students classify each item on the class list as a "high energy" or a "low energy" user. (gasoline and electricity - or body power)

Extending the lesson:

1. Describe the relationship between lifestyles of people and their needs, wants, and dreams.
2. Now draw a picture of a hungry child in their "dream world."
3. Ask: How is the "dream world" of a hungry child like the dream of the hobo in "The Big Rock Candy Mountain"?
4. Describe the effect on your "dream world" of a shortage of:
   - a. electricity
   - b. gasoline
   - c. food
   - d. sunlight
5. Write a short paragraph describing how you would reach your "dream world."
6. Add to the class energy word list.

Materials: The record, "The Big Rock Candy Mountain"

Title: An Energy Tour Of My Community

Concept: People use energy for community needs.

Objective: To give students the opportunity to discover the many uses of energy in their community

Introducing the lesson:

1. Plan with your class an energy tour of your community.
2. Ask: What places would we need to visit to study energy supply? (power plant; big coal, oil, and natural and bottled gas distributors; etc.)
3. Ask: What places would we need to visit to study energy use? (the total community - homes, offices, factories, power plant, etc.)

Developing the lesson:

1. If you can, go on the energy tour of your community. If you cannot, use a community map to take a make-believe tour.
2. Make a map, or show on the community map, the energy flow into and out of the community. (You may want to review Lesson 1, Unit II, Grade 5)
3. Trace the source of the energy coming into the community. (oil from Venezuela, Texas, Louisiana, or Arabia; coal from West Virginia, etc.)

Extending the lesson:

1. Locate the big energy users in your community.
2. Locate the small energy users.
3. Invent a plan for making the big energy users into small energy users without putting them out of business.
4. Visit the power plant that supplies electricity to your community.
5. Ask the students to investigate how the power plant uses the waste heat from its electric generators. (This is usually wasted in the air or the "cooling" water of a river or ocean.)
6. Investigate the amount of energy used to supply energy. (It takes more energy to produce food in the U.S. than the food contains.)
7. Find an example of energy being used to make a good change and a bad change in your community.
8. Ask: How did you decide? (values)
9. Add to the class energy word list.

Title: Energy Scarcity

Concept: Energy supplies are limited.

Objective: To discover the relationship between energy supply and demand that results in scarcity

Introducing the lesson:

1. Announce to the class that due to the scarcity of gasoline there will be no school buses next week.
2. Ask: How much gasoline would we save by not using the school buses? (You will get wild guesses.)
2. Ask: How could we find out?

Developing the lesson:

1. Find out how many miles school buses travel each day.
2. Find out how many gallons of gasoline the buses use each day.
3. Calculate the number of miles traveled for each gallon of gas.
4. Ask: Why do different buses get different miles per gallon of gasoline? (more efficient engines, better drivers)

Extending the lesson:

1. Draw a picture of your community without gasoline.
2. Describe your picture.
3. List the machines that could not be used.
4. Ask the students to suggest a better energy-saving practice than not using school buses. (It is better to use buses than private cars.)
5. Have the students calculate how much gasoline it would take if they came to school in private cars.
6. Compare the results with the use of gasoline by buses.
7. Have each student write a short paragraph describing a scarcity of energy that they have experienced.
8. Add to the class energy word list.

Title: Florida - A Consumer State

Concept: Energy supplies are limited.

Objective: To discover the dependence of states without fossil energy sources on other areas of the nation and the world for their energy supplies

Introducing the lesson:

1. Bring in some pictures of oil exploration and drilling in the Big Cypress or other areas of Florida.

2. Investigate the amount of oil produced in Florida every day. (3.1 million gallons, or obtain latest statistics)

3. Find out how much oil is used in Florida every day. (28.2 million gallons, or obtain latest statistics)

Developing the lesson:

1. Ask: Is Florida an energy producing state? (yes)

2. Ask: Is Florida an energy consumer state? (yes)

3. Calculate the amount of oil Florida must import each day (22.8 million gallons); each year (365 days x 22.8 million gallons). Use latest statistics if available.

4. Investigate from where oil is imported into Florida. (i.e., Venezuela)

Extending the lesson:

1. Locate the states in the USA that produce more oil than they use. (Alaska, Louisiana, Texas)

2. Locate nations with surplus oil supplies. (Venezuela, Mexico, Arab states, Russia)

3. Trace the routes oil tankers would take to get oil from these nations to Florida.

4. Discuss the danger to Florida's economy and people if there is an oil shortage or embargo.

5. Investigate the alternatives to the use of oil. (coal and nuclear power plants; solar heating; no substitutes for gasoline at present)

6. Draw a picture of your section of Florida without oil.

7. Do a similar study for coal, natural gas, food.

8. Add to the class energy word list.

Title: A "Letter To The Editor"

Concept: Modern lifestyles in the USA are dependent on energy supplies in unlimited quantity at a reasonable cost.

Objective: To discover the relationship between energy use and lifestyle or standard of living

Introducing the lesson:

1. For a week or so before doing this lesson, from your local newspaper collect "letters to the editor" that relate to energy in any way.
2. Read the letters to the class.
3. Ask: What energy problems are people concerned about?

Developing the lesson:

1. Ask the students to write a letter to the editor about any energy topic they wish.
2. Tell the students that TV has been banned in order to save electricity. Ask them to fantasize their lives without TV and write a letter to the editor describing their new lifestyle without TV.
3. Ask the students to estimate the energy costs of their alternate activities.

Extending the lesson:

1. Trace the history of energy use in the USA. (solar, animal, water, wind, steam, fossil, nuclear)
2. Create a picture or cartoon that tells the same story as your letter to the editor.
3. Make a list of all the words the class can think of that represent energy waste.
4. Use the energy-waste words to write a plan for energy conservation.
5. Add to the class energy word list.

Title: The Search For Energy Affects The Environment

Concept: People and environments are in constant change.

Objective: To discover the relationship between the search for new energy sources and the effects on the environment - its land, air, water, and living things

Introducing the lesson:

1. Ask the students to show in any way how man's search for energy sources affects the environment.
2. Have each student share the effects shown with the class.

Developing the lesson:

1. Draw a picture of people changing the environment to get more energy. (oil, natural gas, wood, coal, electricity)
2. Discuss the changes in your picture.
3. Explore the effects of these changes on people.
4. Design a plan to lessen the effects of man's search for energy.

Extending the lesson:

1. Investigate how man uses energy in the search for more energy. (energy used in exploration)
2. Draw a picture to show how the use of energy affects the environment.
3. Now show the effects on people.
4. Investigate why man's search for new energy sources is getting more difficult. (Easy-to-get sources have been used up. New sources are in harsh climates, deep in the ground or sea, etc.)
5. Add to the class energy word list.

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ENERGY TEST

A Pre-test And Post-test Evaluation Instrument

Grade 6

1. What is a calorie? (the amount of heat energy needed to raise the temperature of one cubic centimeter - 1 gram - of water one degree Celsius, at sea level)

2. Construct an energy chain for an appliance. (uses energy for raw materials, production, packaging, delivery, use, disposal)

3. List five ways of preserving energy (foods) for storage. (salting, drying in sun, canning, freezing, smoking)

4. The loss of energy in the operation of an electric power plant can be as high as:

    a. two-thirds (correct answer)
    b. one-half
    c. one-third
    d. one-quarter

5. Give three reasons for the warm climate of Florida. (geographic location, amount of sun, intensity of sun, angle of sun's rays, Gulf Stream, Gulf of Mexico)

6. How does Florida's warm climate affect the following:

a.	population	(growing, retirees, diverse)
b.	tourism	(winter visitors)
c.	industry	(fishing, water sports, winter crops, housing)
d.	wildlife	(winter home for birds)
e.	energy use	(more energy for cooling, less energy for heat)

7. Compare truck and rail transportation for:

a.	speed	(truck faster)
b.	delivery	(truck more direct)
c.	labor	(trucks use many more people to drive)
d.	energy use	(trucks use much more fuel)

8. What fuel is in shortest supply in the world? (wood for cooking)

9. What is the effect of people's use of dried animal manure as fuel? (loss of fertilizer to grow food)

10. How are the limits of supply of all energy sources related? (scarcity of any one source affects the others -- less oil means less fertilizer means less food, etc.)

11. How can nations use energy supplies to influence the actions of other nations? (Arab oil embargo, Mexican gas pricing)

12. What are synthetics? (petroleum-based substitute products such as plastics, fertilizers, fibers)

13. What are the two biggest uses of crude oil? (gasoline and heating oil)

14. What traffic law was passed to save gasoline? (55 mph speed limit on highways)

15. What type of transportation uses more than half of all the gasoline produced? (automobiles)

GRADE 6, UNIT I, LESSON 1

Title: A Calorie Count

Concept: Energy comes in many forms.

Objective: To discover the relationship between food types and the amount of energy they contain

Introducing the lesson:

1. Make a bulletin board display of overweight people doing something, preferably eating.
2. Add some magazine articles or advertisements for programs to lose weight easily or quickly or both.
3. Ask the students to keep a record of everything they eat or drink for a week so they can calculate their calorie intake.
4. Weigh and record weight of each student at the beginning of the week.

Developing the lesson:

1. Determine the definition of a calorie (the amount of heat needed to raise the temperature of one cubic centimeter - one gram - of water one degree Celsius at sea level)
2. Repeat the "nut-burning" demonstration in Lesson 2, Unit II, Grade 4, as a means of showing the relationship between food and the production of heat.
3. Ask the students to suggest an investigation to measure the calories in half a walnut. (Measure weight of nut and temperature of water before and after burning. How many cubic centimeters of water can you boil with how much walnut?)
4. Determine from a calorie chart the calorie content of:
    a. ice cream
    b. banana
    c. peanut butter
    d. jelly
    e. donut
    f. cola drink
    g. your favorite dessert
    h. cookie
    i. steak
    j. cake and pie
5. Ask: What is diet cola?
6. Ask the students to investigate what other foods in their local supermarket are "diet" foods.
7. Ask: What is the source of calories in a soft drink?
8. Ask: What is the substitute "sweetener" in diet foods? (read the food package labels)

Extending the lesson:

1. At the end of the week, have each student calculate the number of calories per day taken into their bodies.
2. Compare their figures with recommended amounts for sixth graders.
3. Compare total calorie intake of students in the class.
4. Identify the "big eaters" and the dieters.
5. Compare the calorie values of regular meals with "snacks."
6. Investigate the role of the Food and Drug Administration regarding materials used in food.
7. Investigate the possible harmful effects of sugar substitutes to human health. Ask: Why is there a warning label on products containing saccharine?
8. Draw a picture of yourself enjoying your favorite meal or snack.
9. Put a funny caption on your picture.
10. Have the students weigh themselves again and compare their weight with their weight at the beginning of this lesson.
11. Start a list of energy words learned in this lesson - an energy vocabulary -- "ENERWORDS."
12. Ask the students to use one of the "ENERWORDS" in a story of their eating habits.

Materials: Food Calorie Chart

Title: "Power"

Concept: Energy comes in many forms.

Objective: To develop a concept of "power"

Introducing the lesson:

1. Ask the students to find photographs or magazine pictures which demonstrate "power."
2. Make a bulletin board display of "power."

Developing the lesson:

1. Ask the students to find examples of different kinds of power. (electric power, people power, body power, fast power, slow power, silent power, noisy power, any other kind of power, "me" power)
2. Draw a picture of a friend using power.
3. Put yourself in the picture to change the power being used by your friend.

Extending the lesson:

1. Have students classify the class power pictures, placing them in order from the most powerful to the least powerful.
2. Classify them in another way.
3. Take the class on a field trip to your local electric power plant.
4. Investigate the community use of electric power.
5. Identify the big power users.
6. Write a paragraph describing power.
7. Add to the class energy word list.

Title: An Appliance "Energy Chain"

Concept: Energy can be changed from one form to another.

Objective: To discover the relationship between the appliances students use and the energy needed to produce and operate them

Introducing the lesson:

1. Review the lesson on "food energy chains." (Lesson I, Unit III, Grade 5)
2. Ask each student to make a list of all the appliances they use.

Developing the lesson:

1. Ask the students to pretend that their favorite appliance is alive and construct an "energy chain" for that appliance similar to a food energy chain.
2. Ask: Why is it more difficult to construct an energy chain for an appliance than for a food chain? (Appliances use energy for raw materials, construction, packaging, delivery, as well as use.)

Extending the lesson:

1. Construct an energy chain for an object that is not an appliance; for example, an automobile.
2. Compare relative use of energy in the various stages of appliance development and use.
3. Compare energy use for the appliances on the class list.
4. Draw a picture of your life without your favorite appliance.
5. Describe your picture.
6. Write a paragraph describing how your favorite appliance has changed the lifestyles of people.
7. Add to the class energy word list.

Title: Concentrated Energy

Concept: Energy can be changed from one form to another.

Objective: To discover the relationship between amounts of energy and the kinds of storage used

Introducing the lesson:

1. Have the students investigate the preparation and use of dehydrated foods by hikers, campers and explorers.
2. Ask: Why did people want to have their food energy sources in a concentrated form? (Without water, food has less weight and bulk. Water is added to food at time of cooking.)
3. Investigate other methods of food energy concentration for storage. (A cake or candy is concentrated energy.)

Developing the lesson:

1. Investigate the process for preparing frozen orange juice concentrate.
2. Ask: How has the frozen food industry changed the eating habits of people? (Before frozen foods, all fresh foods were available only at the time of harvest. Now, fresh foods are available all year long.)
3. Investigate other methods of food concentration or preservation for storage. (dehydration by drying in the sun, salting, or smoking)

Extending the lesson:

1. Investigate methods of canning.
2. Investigate "old-time" methods of food concentration by explorers, such as "jerky" and "pemmican."
3. Ask: What was the principal ingredient of these concentrated foods? (fat)
4. Make a list of the foods you would have to give up if electricity shortages dictated no further use of electricity for freezing.
5. Draw a picture of your family life without your freezer or the freezer in the local supermarket.
6. Describe your picture.
7. Add to the class energy word list.

Title: Heat Is Lost

Concept: Energy can be changed from one form to another.

Objective: To discover the relationshiop between energy change and loss of heat

Introducing the lesson:

1. Have students find advertisements in newspapers and magazines for products to reduce heat loss in homes, engines, and machines.
2. Make a bulletin board display of the different kinds of advertisements for products designed to reduce heat loss.

Developing the lesson:

1. Ask: What do we call products that reduce heat loss? (insulation, lubricants, etc.)
2. Ask: Where did all this excess heat come from? (burning of fuels, friction, etc.)
3. Did any of the students find an advertisement claiming to eliminate heat loss entirely. (Look for home insulation advertisements.)
4. Investigate the loss of energy (heat) in the operation of an electric power plant. (Less is estimated to be as big as two-thirds of the energy used - coal, oil, nuclear)

Extending the lesson:

1. Invent a way to utilize the wasted heat from an electric power plant.
2. Discuss the reasons why this heat probably could not be used as you suggested. (Power plants are too far away from cities to use heat to heat homes or offices; too costly to transport hot water without losing heat from pipes.)
3. Draw a picture of yourself or a friend enjoying wasted heat.
4. Investigate the effectiveness of various types of thicknesses of insulation materials for buildings.
5. Invent a way to keep an ice cube from melting in your hand.
6. Have a class contest to see who has invented the best way to keep the ice cube from melting.
7. Compare the melting time with an ice cube without any covering or insulation.
8. Add to the class energy word list.

GRADE 6, UNIT III, LESSON 2

Title: Energy Inventors

Concept: Environments are in constant change.

Objective: To learn about the inventors and scientists whose work made our high energy society possible and the changes that resulted from their inventions, both to people and to their environment

Introducing the lesson:

1. Read about the inventions of Thomas Alva Edison.
2. Ask the students to describe the first light bulb, battery, and power station.

Developing the lesson:

1. Investigate the work of Watt, Volta, Ohm, Ampere, Faraday, Black, Fahrenheit, Celsius, Franklin, Joule, Carnot, Young, Einstein, Fermi, and Galileo.
2. Ask: Why do some of these names seem familiar? (Many of their inventions were named for them.)
3. Ask: What is a kilowatt? (1000 watts)
4. Write a letter to Thomas Edison describing the effect his inventions have had on your life and the life of the community.

Extending the lesson:

1. Read about the work of Henry Ford and John D. Rockefeller in the development of energy and transportation.
2. Ask: What effect has the automobile and gasoline had on the lifestyles of people?
3. Discuss the changes that resulted from other energy inventions and discoveries. (steam engine, nuclear, etc.)
4. Draw a picture of your life without gasoline or electricity.
5. Add to the class energy word list.

GRADE 6, UNIT IV, LESSON 1

Title: The Sun Affects Our Climate

Concept: The sun is the chief source of the earth's energy.

Objective: To discover the relationship between solar energy and the climates of the world

Introducing the lesson:

1. Have the students collect advertisements featuring the climate of Florida.
2. Make a bulletin board display of the advertisements.
3. Ask: What can we learn about the attraction of the climate of Florida on the housing, tourist, fishing, and other industries?

Developing the lesson:

1. Investigate the reasons for Florida's warm climate. (geographical location, amount and intensity of the sun, angle of the sun's rays, etc.)
2. Ask: What does the term "tropical" mean?
3. Compare the length of daylight and the average yearly temperature of your community in Florida with Chicago, Atlanta, Washington, D.C., and Anchorage, Alaska.
4. Consider other factors which influence Florida's climate that are indirectly related to the radiant energy of the sun. (Gulf stream, warm waters of the Gulf of Mexico, summer showers)

Extending the lesson:

1. Investigate the effects of Florida's warm, sunny climate on:
    a. population - growing rapidly, older than average
    b. tourism - a warm winter vacation place
    c. industry - fishing, housing, agriculture (winter crops)
    d. wildlife - winter home
    e. any other
2. Draw a picture of a tourist enjoying a Florida vacation.
3. Describe your picture, telling how the climate affected the activities shown in your picture.

4. Discuss the harmful effects of the Florida sunshine. (sunburn, skin cancer, etc.)

5. Write a letter to a northern friend telling of the "wonderful climate" of your area of Florida.

6. Design a billboard to be placed along northern highways telling people about Florida's climate and the lifestyles of people.

7. Add to the class energy word list.

GRADE 6, UNIT IV, LESSON 2

Title: People Worship The Sun

Concept: Solar energy can be used directly.

Objective: To discover how people throughout the ages have worshipped the sun and its energy

Introducing the lesson:

1. Ask the students to collect pictures of the sun, sunrises, and sunsets.
2. Make a bulletin board display of the pictures.

Developing the lesson:

1. Ask the students to draw a picture that expresses their feelings about the sun.
2. Find examples of modern "sun worship."
3. Ask: How has modern sun worship affected industries in Florida? (suntan lotions, retirement, vacations)

Extending the lesson:

1. Investigate the worship of the sun god RA in ancient Egypt. (inscriptions on inside walls of pyramids of Sixth Dynasty - 2500 B.C., the "Pyramid Texts," in which the sun god RA carried the Pharoah's soul on his skyboat into the West, where lay the land of the dead)
2. Read in the National Geographic magazine for November 1970, about the restoration of Akhenaton's Temple to Aten, the solar disc.
3. Investigate the Akhenaton concept of a single supreme sun god. (the solar disc - the unification of all the former sun gods into one image of Aten) This concept influenced religious thought in the Middle East until the time of Jesus and Muhammed.
4. Read and discuss this passage from the Vedic Hymns (Hindu), circa 1400 B.C.: "And when the Sun arose, they could not understand how this newborn God could wield such power. And they said: Let us worship this Child of Sky. He stands up as a mighty flame; he stretches wide his arms; he is everywhere like the wind."
5. Investigate this Vedic concept's influence on the writings of Thoreau. (See Walden, Chapter 2, for insight into Thoreau's regard of the sun as the visible symbol of some yet-to-be-evolved human grandeur. Throughout Walden, he compares daybreak with spiritual awakening.)

6. Have one of the students read Walt Whitman's "Song of Myself." (a primitive psychological idea that light from an inner sun is emitted through the eyes and mixes with the eternal light of the sun to make visual perception possible -- a notion as old as Empedocles, 5th Century B.C.).

7. Investigate the "CIWILTKONIA," a sun ceremony of the Papago Indians of the southwestern U.S. (Dancers circle a sand painting of the sun and thereby recharge themselves with its life-giving energy.)

8. Make up a "CIWILTKONIA" dance.

9. Do it!

10. Read to the class Franz Boas' description of the "Prayer at Sunrise" of the Kwakiutl Indians of the Pacific northwest, and ask the students to discuss: "Welcome, Great Chief, Father, as you come and show yourself this morning. Let nothing evil befall on me this day which you have fashioned according to your wishes, Great One, Walker-Across-The-World, Chief."

11. Draw a picture to express your own feelings about a sunrise.

12. Describe your picture.

13. Add to the class energy word list.

GRADE 6, UNIT V, LESSON 1

Title: Energy For Transportation

Concept: Energy is used to move things.

Objective: To discover the relationship between energy use and transportation

Introducing the lesson:

1. Take the class out to a place on the school grounds where they can see a highway.
2. Ask the students to investigate and list what is being transported during a twenty-minute period.

Developing the lesson:

1. Make a class list of what was being transported.
2. Was most of the material being transported locally or from out of state?
3. Ask the students to suggest a way that each material could be moved using less energy.
4. Investigate the relative energy use for trucks and trains in transporting goods.
5. List the advantages and disadvantages of truck and railroad transportation. (speed, delivery, labor, etc.)

Extending the lesson:

1. Investigate people's use of energy for transportation:
    a. needs (basic to survival)
    b. wants (do not need for survival)
    c. dreams (may never get)
2. Ask the students to check their own use of energy for transportation.
3. Ask the students to draw a picture of their transportation dream.
4. Investigate your community's needs for transportation.
5. Ask: Why have the railroads declined in popularity?
6. Compare how cattle are transported today with 100 years ago. (cattle drives)
7. Compare transportation in USA with other nations.
8. Add to the class energy list.

Title: Energy Use in Other Nations

Concept: People use energy to satisfy their needs.

Objective: To discover the patterns of energy use in other nations

Introducing the lesson:

1. Have students bring in pictures showing how people use energy in other nations.
2. Make a poster for each nation. Paste each nation's pictures on the appropriate poster.
3. Group the "developed" and the "under-developed" nations on the basis of energy use.

Developing the lesson:

1. Consider energy use for basic needs:
    - a. cooking
    - b. food production
    - c. shelter, including heat and light
2. List the nations that use wood as the principal cooking fuel.
3. Do the same for peat, natural gas, coal, oil, electricity.
4. Find the places that do their work by:
    - a. solar energy (animal and body power)
    - b. wind power
    - c. water power
    - d. electric power
    - e. all of these

Extending the lesson:

1. Investigate changes in the lifestyles of people in the USA as a result of changes in primary energy sources. (from wood to coal to oil to electric, nuclear, solar)
2. Do the same for people in other places - Eskimo, Arab, Chinese, etc.
3. Predict future changes as oil supplies are depleted.
4. Draw a picture of someone changing a lifestyle as a result of the discovery of a new and unlimited source of energy.
5. Describe your picture to the class.
6. Add to the class energy word list.

Title: A "Do-it-Yourself" Blackout

Concept: Energy supplies are limited.

Objective: To discover the relationship between lifestyles and energy supply availability

Introducing the lesson:

1. Tell the students that you are going to ask them to plan a "do-it-yourself" blackout in your school. (no electricity)
2. Ask for suggestions for the class plan.

Developing the lesson:

1. Divide the class into committees to discuss and outline parts of the plan. (Let the students decide what committees are needed.)
2. Have each committee suggest alternative energy sources for heating, lighting, cooking, etc.
3. Have the committees report to the class for suggestions and approval.
4. Draw up a consensus blackout plan.
5. Get the principal's permission to put your plan into operation.
6. Pull the plug!
7. Caution: Turning everything back on at the same time could increase demand charges. Schedule "turn ons."

Extending the lesson:

1. Develop additional plans to reduce the amount and length of time you must use artificial lighting, heating, cooking, etc. in the school.
2. Plan a blackout for your home and report back to the class.
3. Draw a picture of yourself before and during the blackout.
4. Write a story describing your school without electricity.
5. Add to the class energy word list.

Title: A World Without Energy

Concept: Energy is essential for the future of humankind.

Objective: To discover the relationship between the future of energy supplies and the future of humankind

Introducing the lesson:

1. Say: Some experts predict that, at the presently increasing rate of energy consumption, the world may be out of oil soon after the year 2000 A.D. Ask the students to think of their world without oil.
2. Ask the students to draw a picture of their community on the day the oil supplies run out.

Developing the lesson:

1. Describe your environment without oil and oil products - heating oil, gasoline, lubricants, plastics, fibers.
2. Have each student survey their room at home to see what would be left if they took everything out that was made of synthetic materials.
3. How would that room compare with a room in a pioneer homestead? (similar, all wood construction)

Extending the lesson:

1. Describe a world without wood, coal, natural gas.
2. It has been said that if the U.S. gave the hungry people of the world all the food they needed, they would not have the fuel to cook it. Discuss this situation with the class. Investigate people's search for wood for cooking.
3. Investigate results of people's use of dried animal manure as fuel. (loss of fertilizer to keep soil rich)
4. Ask: How is man planning for future energy supplies? (In many cases, the research being done may be too late, as supplies forecasted dwindle and the deserts of the world spread.)
6. Investigate the limits of energy supplies and how they are related:

   a. food   b. oil   c. coal
   d. nuclear   e. solar   f. natural gas

7. List the environmental problems of increasing the supplies of each.
8. Add to the class energy word list.

GRADE 6, UNIT VII, LESSON 1

Title: Lifestyles and Energy

Concept: People depend on the environment for their energy.

Objective: To discover the relationship between energy supplies and our standard of living

Introducting the lesson:

1. Ask the students to invent a way to compare the energy demand for the basic needs; the "wants"; and the dreams of people.
2. Ask them to share their inventions with the class.

Developing the lesson:

1. Have the students devise an energy formula that measures the differences between people's energy "needs" and energy "wants."
2. Draw a class mural that shows how energy shortages cause changes in societies and the way people live. (lifestyles)
3. Discuss how such changes in people and societies could lead to conflict.
4. Have students write stories about their present lifestyles in comparison to their "needs," "wants," and "dreams."

Extending the lesson:

1. Show how governments and people use energy supplies to make other governments and people do things they want. (oil embargo, food exports, etc.)
2. Compare energy needs and wants in the U.S. with those in other nations.
3. Compare different energy needs and lifestyles within the U.S.
4. Do the same for your community. (How many private airplanes are there, for example?)
5. Create a dance, a verse for a song, a poem or a picture that shows how we use energy to maintain our lifestyle or standard of living.
6. Share your creation.
7. Add to the class energy word list.

Title: Energy Waste -- Or -- Conservation?

Concept: Energy can be saved through a program of energy conservation.

Objective: To discover the relationship between energy shortage, waste, and conservation

Introducing the lesson:

1. Take the class on a survey of the school to identify energy waste.
2. Ask each student to quietly list each example seen.

Developing the lesson:

1. Make a list of all energy waste in the school.
2. Devise a method to eliminate each example of waste listed.
3. Present the list to your principal and/or custodian.

Extending the lesson:

1. Create a poem, picture, dance, song or whatever, to reveal your feelings about energy waste.
2. Describe the values you hold which cause your "feelings."
3. Survey students' feelings about the "energy crisis."
4. Organize an "Energy Awareness Week" at your school.
5. Create a TV commercial promoting energy conservation in the community.
6. Convert your TV commercial to poster "ads."
7. Use your "ad" to change energy use in your classroom, school, or home.
8. Prove that your posters caused a change in energy waste.
9. Design a sign, without words, to urge public energy conservation.
10. Design awards -- "ENERWARDS" -- for people who conserve energy.
11. Do the same for businesses, clubs, etc.
12. Add to the class energy word list.

ENERGY AND MY ENVIRONMENT

SUPPLEMENTAL ACTIVITIES

FOR

GRADE FOUR, GRADE FIVE, GRADE SIX

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Title: Energy In My Life

Purpose: To explore light, heat, and motion as forms of energy and their relationships to the ability to do work.

Materials: A candle, an electric lamp with a shade, bulbs of various wattages, a toy car

Procedure:

1. Demonstrate to the class the ability of the candle to provide heat and light. Discuss the energy involved. Discuss the materials used and the procedures for making the candle.

   Have students devise demonstrations using a candle and other materials to increase the amount of heat and light available from a candle. Emphasize caution with open flame. Use nonflammable materials for experiments.

2. Put a low-wattage bulb in the lamp. Put the shade on the lamp. Plug in and note the amount of light. Take the shade off, note the difference. Change bulbs (be careful with the heated bulb) and discuss differences in light using different bulbs with shade on and off. Discuss how electricity is produced and how electric energy is used to do work for students at school and at home.

3. Have a student push the toy car from one end of the room to another. Discuss the source of energy to move the car. (student energy) Discuss what gave the student the energy to push the car. (food) Discuss how automobiles and other vehicles move and the sources of energy required for the operation of these vehicles.

GRADE 4, UNIT I, LESSON 2

"Enerwords"

Title: "ENERWORDS"

Purpose: To build a vocabulary of words related to energy and use the words to make a puzzle

Materials: Newspaper articles, magazines, pictures

Procedure:

1. Look for all the different mechanical devices requiring electrical energy in the classroom. (lights, air conditioner, the P.A. system, etc.)
2. Have students describe each device and the function of each electric user.
3. Write down all the words that express "energy."
4. Have students look for more "ENERWORDS" in newspapers and magazines.
5. Have students make up their own crossword or find-a-word puzzles using their new vocabulary.

GRADE 4, UNIT I, LESSON 2

"Enerwords"

Title: ~~"ENERWORDS"~~

Purpose: To present cognitive energy information in the form of a game

Materials: A card for each student divided into 16 squares (for game similar to BINGO), markers (pieces of corn, squares of construction paper)

Procedure:

1. Have the class make a list of energy-related terms on the chalkboard. The list should include at least 25 terms. Have students choose 16 words and write one word or term in each of the 16 squares. The teacher will act as "caller" and will give clues that describe one energy term. When the students know the word or term being described, they will cover that term on their card with a marker. The first student to get four squares in a row calls "ENERGY." The caller then checks the student's answers. If the student is wrong, the game continues and the student is eliminated from the game.
2. As a follow-up activity, students can work in small groups to devise their own game (terms and clues) and then administer it.

GRADE 4, UNIT II, LESSON 1

Title: Stored Energy

Purpose: To describe static electricity and the energy stored in it

Materials: Balloons, comb, small rug

Procedure:

1. Research the meaning of static electricity and why it occurs.
2. Blow up balloons and rub them against the wall. Note how the ballons cling to the wall. Observe the energy stored.
3. Comb a student's hair and watch the hair rise with the elevation of the comb.
4. Have students rub their feet on a rug and touch the door knob or other metal. Discuss what happens.
5. Have students tell stories about their experiences with static electricity.

GRADE 4, UNIT II, LESSON 2

Title: Food - Or - Fuel?

Purpose: To recognize potential energy sources and to determine whether a source can be used for food and/or fuel

Materials: Objects from students' front yards or school yard

Procedure:

1. Gather objects and decide which are potential energy sources. (paper, sticks, leaves, grass, etc.)
2. Separate potential energy sources into piles of like materials. (piles of paper, etc.)
3. Discuss each material as to its use as a food and/or fuel.

GRADE 4, UNIT III, LESSON 1

Title: Change Energy To Move Something

Purpose: To give students an opportunity to use their energy to move something in a game activity

Materials: three ping pong balls, paper, plastic straws

Procedure:

1. Have each student make a paper fan. Play a game using air moved by the fan to move a ping pong ball along a designated line between two points. This game can be played as a relay race with the class divided into teams. Play the game until every student has had a turn.

2. Give each student a plastic straw. Have them blow through their straws and feel the air coming from the ends of the straws. Devise a game using straws and ping pong balls.

3. Devise other games using fans, ping pong balls, and straws to be played inside the classroom or outside on the playground.

4. Play the games.

GRADE 4, UNIT III, LESSON 2

Title: Lost Heat

Purpose: To recognize the value of using insulation materials to save energy

Materials: Newspapers, magazines, homeowners brochures, poster board, paste

Procedure:

1. Cut pictures from magazines and newspapers depicting types of insulation materials.

2. Research and discuss the use of insulation materials to conserve energy.

3. Paste pictures into a scrapbook.

4. Under each picture write a paragraph about that type of insulation and its usage.

Title: Lost Heat

Purpose: To gain insight into conservation of energy by determining which material is a better insulator

Materials: Fruit juice cans, styrofoam insulation, newspapers, black paint, other insulation materials (handle fiberglass with care)

Procedure:

1. Have children bring in fruit juice cans and insulating material, or use materials from a classroom "resource box."

2. Introduce the lesson by asking: What is insulation? Which materials are better insulators? (List on chalkboard in the order of insulating properties as chosen by the class.)

3. Divide the class into groups of three of four. Have each group obtain a fruit juice can and materials they will use.

Group 1:	No insulating material
Group 2:	Paint outside of can black
Group 3:	Styrofoam packaging material (measure thickness)
Group 4:	Newspapers (same thickness as styrofoam)

Have additional groups choose other insulating materials the same thickness as styrofoam such as cloth, fiberglass, insulating materials from a local contractor, plastic.

4. Have each group prepare their juice can. Place an ice cube in each can. Place all cans either in the sun or in the shade. Check the ice cubes at fifteen minute intervals until the first ice cube is melted. Continue to check until all ice cubes are melted. Record the time it takes to melt each ice cube.

DISCUSSION

How did the black paint affect the insulating qualities of the can? Which material served as the best insulator? The poorest? List in order of insulating properties. Compare with original list. How can this knowledge be used to conserve our energy supplies? Should builders be required to insulate homes? Stores? Factories? Ask each student to check how their own home is insulated.

GRADE 4, UNIT IV, LESSON 1

Title: Animals Use Solar Energy

Purpose: To study production and storage of food used by animal species that hibernate in winter

Materials: Science books, encyclopedias

Procedure:

1. Have students gather information about hibernating animals. (bears, snakes, squirrels, etc.)
2. Chart the similarities and differences of each.
3. Discuss how animals store food to be used for fuel to produce energy.
4. Discuss the solar energy used to produce food that is stored by animals for use when food is unavailable.
5. Draw pictures of animals in "Winter Sleep."

GRADE 4, UNIT IV, LESSON 2

Title: A Sun Dance

Purpose: To instruct children in the cardinal directions and the earth's movement as it relates to sunrise and sunset

Materials: Compass, record player, and record of "Sunrise, Sunset"

Procedure:

1. Demonstrate the use of a compass in determining direction.
2. Have students devise a dance to interpret the earth's rotation as it revolves around the sun.
3. Do the dance movements to the record "Sunrise, Sunset."
4. Discuss the importance of the sun's energy to the earth and the system that supports life on earth.

Title: Appliances In My Home

Purpose: To compile an appliance scrapbook to illustrate the varying life-styles of students

Materials: Magazine pictures, photographs

Procedure:

1. Gather magazine pictures, advertisements and photos of appliances.

2. Compile collected pictures in a scrapbook. Research and record data on kilowatts used by each appliance.

3. Assign students to observe the most frequently used appliances in their household and record the frequency of use.

4. Compare appliances used by student households and identify those they have in common.

5. Discuss the conservation of energy by limiting the use of some appliances.

6. Visit an appliance store and record data attached to appliances. Energy Guide Labels are used on refrigerators, freezers, water heaters, dishwashers, clothes washers.

GRADE 4, UNIT V, LESSON 2

Title: "Wants" Become "Needs"

Purpose: To determine whether home electrical appliances are necessities or luxuries

Procedure:

1. Have students bring catalogs, magazines, newspapers to class. Have students cut out pictures of things that need electricity. Put these pictures into two groups: those that their family needs and those "extras" that they enjoy, but are unnecessary.

2. Discuss with the students the idea of necessities (needs) and luxuries (wants). After they have classified their pictures, have the students choose ten electrical items that they feel are necessary to maintain their lifestyle. (Those they can't do without.) Have the students make a collage or mobile of the ten necessities.

3. Have students list 12 of their favorite items in their home that require electricity to operate.

    a. Say: If there were a decree that said you had to use less electricity, draw a pencil line through the three items you could really do without

    b. Say: Circle in pencil the three that really mean the most to you and that you would hold on to until the very end.

    c. Say: Now look back over your list and your decisions and consider:

        o Why did you decide to do without the three items?

        o Why did you want to keep the other three?

4. Say: Again based on Questions 3a and 3b, list the efficiency steps you can take to reduce the electricity consumed by each of the three appliances.

GRADE 4, UNIT V, LESSON 3

Title: A Picture Of Energy Being Saved

Purpose: To identify ways by which we might conserve energy and natural resources

Materials: Poster board, marking pens, other art materials

Procedure:

1. Solicit ideas from the class on conservation topics: soil, energy, water, etc.
2. Propose a poster contest and draft contest rules with students' help.
3. Establish a deadline and reward for the best design.
4. As an extension exercise, start a campus campaign against litter. Design and paint attractive trash cans, etc.

GRADE 4, UNIT V, LESSON 3

Title: A Picture Of Energy Being Saved

Purpose: To determine energy-saving bathing practices

Introduction: Students have heard the energy-saving hint that asks the public to take showers instead of tub baths. In this experiment, students can see for themselves that more water and energy is used by taking tub baths. Students can do this activity as a homework assignment. Discuss in class.

Procedure:

1. Have students record data while they take a bath. Fill the bathtub with warm water as usual. Before bathing, measure the depth of the water in inches.
2. When it's time to bathe again, direct the students to take a shower. Tell them: Before you begin the shower, close the bathtub drain so that your shower water will collect in the tub. After taking your shower, measure the depth of water collected in the tub. Compare this depth with your bath water depth. Which used less hot water? By how much?
3. Generally, it takes an ounce of oil or a cubic foot of gas, or one-fourth kilowatt-hour of electricity to heat a gallon of water. Ask students to determine how much oil, gas, or electricity it took to heat their bath and shower water.

GRADE 4, UNIT V, LESSON 3

Title: A Picture of Energy Being Saved

Purpose: To examine how heat can be saved in homes

Procedure:

1. Divide the class into groups of five with each group representing a "family" of five: father, mother and three children.
2. Announce to all groups that because of a very critical shortage of natural gas and fuel oil, the winter heat allocation to each family is being reduced by 20 percent.
3. Challenge each group to prepare a list of the best ways they can think of to deal with the problem.
4. Ask them to think about and list what things they can do to keep heat in or cold out of their homes.
    a. Specifically, what can be done by the father?
    b. The mother?
    c. The children?
5. How can they still be comfortable if they reduce the temperature in their homes?
6. Have each "family" draw a picture of "their" home showing how each member of their family is saving energy in areas of their home.

GRADE 4, UNIT VI, LESSON 1

Title: Is There An "Energy Crisis"?

Purpose: To define the concept of a crisis, its cause, and ways we might avert a crisis

Activity: Essay or Composition

Procedure:

1. Instruct students in the mechanics of writing an essay.

2. Have students visit the library to look for information on an oil shortage, coal shortage, and the reasons behind the shortages.

3. Write a paper based on the shortage of an energy resource.

4. Follow up with a class discussion and make comparisons of price increases of these resources relative to their availability.

5. An alternative exercise might be to collect news articles pertaining to the history of oil sold to the United States by OPEC nations; chart the consequences at the gasoline pumps.

GRADE 4, UNIT VI, LESSON 1

Title: Is There An "Energy Crisis"?

Purpose: To study individual family uses of electricity and/or natural gas

Procedure:

1. Contact your local electric and gas utility for information on how to read meters.

2. Learn how to read electric and gas meters. Actual electric meters are often available, on loan, from the local electric company. Cardboard models of electric and gas meters can be made easily by students, who then can practice reading a variety of meter settings as they work in pairs or groups of three.

3. After mastering how to read the meters, ask every student to read the gas and/or electric meters in their homes at an agreed upon time (e.g., 5:00 p.m. on Wednesday). Indicate also that they will be reading the meters exactly one week later to determine how much gas and electricity they will be using in one week. Record the data for each family on a classroom chart.

4. After securing the baseline data for one week, announce an "energy saving week." Urge each child to engage their family in seeing how

much they can reduce their gas and/or electricity usage before the next weekly reading will be taken. Record the data for the second week. Which family saved the most? The least? What was the average saving? Children from families that saved the most can be asked to explain how they were so successful. Was it hard or easy to save energy?

Caution - This activity should be done, if possible, during a period of relatively stable temperatures such as dead of winter, early fall, or late spring. At other times, however, children can be helped to understand how changing outside temperatures affect energy use.

GRADE 4, UNIT VI, LESSON 2

Title: Running Out Of Body Energy

Purpose: To understand that humans can also experience an energy shortage or loss

Materials: Pencil and paper

Procedure:

1. Choose a quiet time to ask students how they feel. (rested)
2. Tell them that they are going to jog in place for a few minutes.
3. Have the class jog in place for as long as they have energy.
4. As students begin to tire and sit down have them write a statement about what it feels like to run out of energy.

Title: Running Out Of Body Energy

Purpose: To become aware of energy usage in our food production system

Procedure:

1. Arrange to have a pizza party as a classroom activity. If possible, involve parents or the school lunchroom program personnel to make the party a no-cost or very low-cost activity for the pupils.

2. Ask the persons preparing the pizza to use a great variety of ingredients: tomatoes, flour, cheese, anchovies, meat, pepperoni, etc.

3. During the party, engage the children in identifying the ingredients they see or taste and list them on the chalkboard.

4. For each ingredient listed, ask two or three children to research that food and report to the class on some of the energy required to make that food available for their pizza. (Energy from the sun for plant growth, energy to cultivate and harvest food crops, energy to can the foods, and energy to transport the foods are examples of the energy involved.)

5. After the individuals or groups have reported to the class, engage the entire class in considering the extent to which our food tastes and habits have resulted in heavy energy usage.

6. How might a very serious energy shortage change our eating habits?

7. Draw a picture of your favorite pizza.

GRADE 4, UNIT VII, LESSON 1

Title: Plants Store Energy

Purpose: To discern the role of plants in the ecosystem by identifying the dependency of animals and people on plants

Materials: Copy of the poem "Trees," manilla paper, paints or crayons

Procedure:

1. From your local forestry service, get information on the life history of various kinds of trees.
2. Read the poem, "Trees," and discuss.
3. Have students draw a lifeline for a tree from a seedling to maturity. Include all the natural calamities that could happen during the life of a tree, such as a forest fire, drought, cut for timber, etc.
4. Have students prepare a list of the consumer products made from trees.
5. Discuss: What if there were no trees?
6. Summarize the activity by showing the Dr. Seuss movie, "The Lorax."

GRADE 4, UNIT VII, LESSON 1

Title: Plants Store Energy

Purpose: To show the role of solar energy in producing biomass

Procedure:

1. Involve two or three children in a project to determine the gain in weight (mass) that occurs when a plant is grown from a seed.
2. Weigh carefully the amount of dry potting soil necessary to fill a flower pot. Moisten the soil and plant a small seed such as a lima bean or pea that has been weighed carefully on an analytic balance by a high school science student or teacher. Record the weight.
3. Place the flower pot on a window ledge in the classroom where it will receive available sunlight. Water as needed, and permit it to grow for several weeks.

4. Remove the plant and as many roots of the plant as possible from the soil, being careful to save the soil, since all soil used in the project should be dried and reweighed to ascertain the loss, if any, from the original starting material.

5. Dry the plant and roots thoroughly and weigh. How does the weight of the plant grown compare to the weight of the original seed? How does the weight of the plant compare with the change of weight in the soil. Where did the gain in weight come from?

6. How important was sunlight in this experiment? Could the dried plant be burned to produce energy? Where did that energy come from?

GRADE 4, UNIT VII, LESSON 2

Title: Energy Use Affects My Environment

Purpose: To give students the opportunity to identify their greatest energy use and the effect it has on their environment

Materials: Chart paper and pens

Procedure:

1. Have students identify their greatest energy users: television, radios, lawn mowers, dishwashers, hair dryers, etc.

2. Have students draw a chart listing the energy users in the first column.

3. In the second column show the sources of energy used to produce and operate the energy user.

4. In the third column list the possible environmental effects caused by the production and operation of these energy users.

Title: Energy Use Affects My Environment

Purpose: To analyze the effects of conservation compared to unlimited consumption

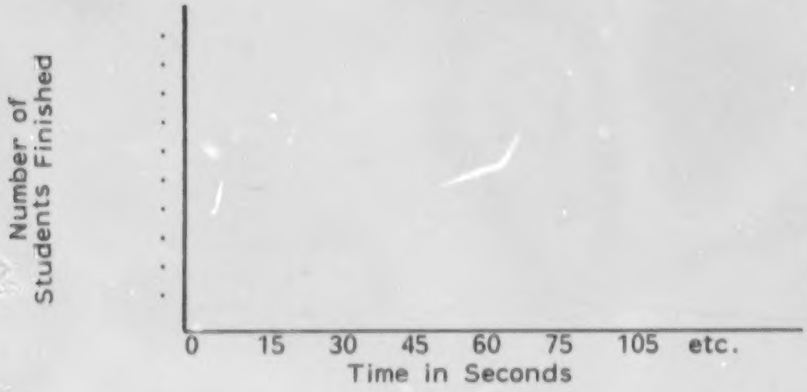
Materials: Two chocolate chip cookies per child, clock or timing device, chalkboard for timegraphs

Procedure:

1. Give each child a cookie.

2. When the signal is given, have the children begin eating the cookie. They MUST raise a hand when they finish. Count the hands that are raised every 15 seconds until all cookies are consumed. At the last count all hands should be raised. Once a child raises a hand, it must be kept up.

3. Create the graph. Indicate how many students are finished eating every 15 seconds.



4. Discuss with the students the interpretations. Tell students that one cookie equals one coal deposit.

    a. After 15 seconds, how many coal deposits were consumed?
    b. After 30 seconds, how many?
    c. After 45 seconds, how many?
    d. After 60 seconds, 75 seconds, 90 seconds, etc.?

5. Distribute the second cookie. This time, children can only take a bite when you say, "Take a bite" (every 15 seconds). The system is the same - the student raises a hand when finished and you tally every 15 seconds.

6. Construct Graph No. 2 (same format) and record data. This graph usually indicates that the cookie lasted longer.

7. Analyze the data. How long did it take for all resources to be consumed?

8. Compare Graph No. 1 (unlimited consumption) to Graph No. 2 (limited consumption). How do the results differ? What is the same? When interpreting data, have 10 seconds equal 10 or 100 years. For example: If Graph No. 2 lasted 30 seconds longer when consumption was controlled, 30 seconds x 10 = 300 years. Then go into implications for actual coal deposits and rates of consumption.

9. Using divergent questioning techniques, say and ask:

   a. Tell why you think coal was consumed at different rates.
   b. How did we control the rate of consumption on our second experience?
   c. Does this have any implications for us as we use coal, electricity and natural gas?
   d. Can we help control how rapidly we use resources?
   e. Give your own ideas as to how we can do this.

GRADE 4, UNIT VII, LESSON 2

Title: Energy Use Affects My Environment

Purpose: To examine miles per gallon obtained by the students' family cars

Procedure:

1. Plan with the class to get parental cooperation in detemining miles per gallon obtained by family cars during a common period of time, such as Saturday morning to Saturday morning. Plan, if possible, for children to accompany parents to the filling station and record initial mileage and gallons needed to fill the tank. Return to the station a second time and fill the tank again. Record the final number of gallons and mileage. Ask children (with parental help if needed) to calculate miles per gallon.

2. When data is brought to class the following Monday, organize it into a matrix under headings such as sub-compact, compact, full size, station-wagon and/or other categories deemed appropriate.

3. What kinds of cars were most efficient? Why? Was this a good experiment? How could it have been improved? Whose father or mother gets the best mileage? The worst? Why? Is it a good idea for the EPA to report to the public the results of their mileage tests on new cars? Discuss what kind of car students will buy when they are old enough.

Title: Energy Use Affects My Environment

Purpose: To involve students in planning ways to reduce use of the family car

Procedure:

1. Review with the class the following material from the Citizen Action Guide To Energy Conservation, Citizen's Advisory Committee on Environment Quality, 1700 Pennsylvania Avenue, N.W., Washington, DC 20006.

   "Americans like to use their automobiles. In fact, 54 percent of all car trips in this country are less than five miles. Doesn't that seem unnecessary when frequently we could use public transportation, a bicycle, or walk? Interestingly enough, traveling on family business - going to the doctor or dentist or going shopping - accounts for 31.4 percent of all passenger car trips and averages 5.5 miles one way.

   "What would happen if each family took one less trip a week - e.g., seven instead of eight - by planning ahead to combine errands and appointments so that the car did not have to be used that one time? An average family would save $74 or more a year. This may not be impressive enough on a family scale to some, but if every family did this we would save nationwide:

   38 billion miles of driving
   2.9 billion gallons of gasoline
   and more than
   1.5 billion dollars."

2. Ask children to report the information quoted above to their parents and to plan one or two ways to schedule better the family trips by automobile.

3. Have each child report his family plans to classmates. Plan to have weekly "check-up periods" to see if the better scheduling plans are succeeding.

GRADE 5, UNIT I, LESSON 1

Title: Energy In My Environment

Purpose: To recognize that energy is a part of all things

Materials: Pencil and paper

Procedure:

1. Have students list five things that use or require energy and five things that do not. It will probably be necessary to point out that although many things may not appear to use energy, everything in our environment requires energy in its formation. Therefore, the second list will be blank.

2. From the first list, compile the five things mentioned most often and have the students suggest alternatives or ways to reduce the energy used.

GRADE 5, UNIT I, LESSON 1

Title: Energy In My Environment

Purpose: To understand the meaning and the importance of "energy"

Procedure:

1. Take the class outside (break up into small groups) and write down the ways we can see energy, hear energy, and feel energy. Have each student record their thoughts. Discuss the thoughts recorded.

   a. Ask: What did people use 100 years ago to do the same tasks we just discussed?

   b. Ask: What will people use 100 years from now for energy?

2. Another way to look at it:

   a. Ask students to list 10 or more ways they use energy.

   b. Ask students to list how many of their present uses of energy could be eliminated or reduced.

   c. Ask: How would we survive if our energy sources were all used up?

   d. Ask: When was the car invented? the fan? the air conditioner? When was electricity discovered?

   e. Have students rank the listed uses of energy from most important to least important.

Title: Energy In My Environment

Purpose: To develop the understanding that we use energy in many ways and, because of this, we must learn to use it more wisely

Objectives: Students should be able to:

1. Tell how energy is helpful to them in their homes.
2. Suggest ways energy can be used wisely.

Materials: Pencils, crayons, manila paper (18" x 24")

Background Information: Energy benefits us in many ways. It warms and cools our houses and other buildings, provides transportation, and powers the many engines and processes of industry to improve our lives.

However, the resources needed for production and use of energy are in limited supply. Fossil fuels, such as oil and natural gas, are in very short supply. Conservation of energy resources is essential. But conservation will require a change in our attitudes and lifestyles. Turning off lights, driving fewer miles, turning down the thermostats, are common ways to save energy. The point of this lesson is that conservation works only when everyone cooperates.

Procedure:

1. This lesson is best opened with an energy tour around the school. After returning to class ask: Can someone say how energy helps us here in our classroom? In our school? Can you think of another place where energy is helpful to us? (home) How is energy helpful in our homes? (Have children give examples.)

2. Develop the lesson by asking if there are other ways energy is used in our homes. Distribute manila paper to each child. Say: Fold your paper in half lenghtwise. (Show them.) Fold it in half crosswise. How many rectangles do you have? (4) Let's pretend each is a room in your house. (These four rooms should be stated: bedroom, bathroom, kitchen, living room. If you wish to do so, you may add other rooms on the other side of the paper.) As children say the name of each room, print it on the board for them to see. Have the children copy a name on each square.

3. Ask the students to take this paper home and draw as many energy users in each room of their house as they can. Who could help them with ideas? Encourage the students to get their parents to help.

4. Draw four large rectangles on the chalkboard and label them kitchen, bedroom, living room, and bathroom. Discuss each room in turn, asking what energy users the children found. As each energy user is mentioned, have a child draw it on the board.

5. Pull the entire lesson together with a statement similar to this one: Look at all the things we found that are energy users. These energy users are also energy helpers. Just think how much energy they use when people in every home turn on these things.

6. Most of the energy we use comes from fossil fuels that took so long to be made. We want to make sure that they don't run out. How can you help? (Accept and discuss the suggestions the children give.)

7. Distribute another large sheet of manila paper. Have each child draw one way to save energy. Use their pictures for a bulletin board. Suggestions may be:

After use, turn off:	lights radio TV electric blanket faucets
Turn up or down:	air conditioner furnace
Use less energy:	use push mower instead of power mower take fewer car trips use bicycle instead of car, or carpool
Save energy by:	closing doors and windows when air conditioner is running insulating around windows, doors, and attics closing refrigerator door quickly

Optional:

1. Have a student demonstrate a simple circuit using a dry cell and a light bulb. Add extra light bulbs to the circuit. Notice what happens to the amount of light given off by each bulb as another is added. (Less until they go out.)

2. Duplicate Home Energy Check List on next page. Have students take it home, check the actions that they did to conserve energy. Lines 7, 8, 9, 10, 11 and 12 are for actions other than those listed.

HOME ENERGY CHECK LIST	Mon	Tues	Wed	Thur	Fri	Sat	Sun
1. Turn off the light.							
2. Turn off the thermostat (with parent's permission).							
3. Walk to the store.							
4. Turn off the faucet to stop the drip.							
5. Take a short shower instead of a bath.							
6. Pull drapes or curtains to keep the house warm at night. (in winter)							
7.							
8.							
9.							
10.							
11.							
12.							

Title: Making Things Move Faster

Purpose: To discover the relationship between amounts of work done and energy used

Procedure:

1. Have six students, sitting in their seats, count the rate of their pulse for 30 seconds and record their pulse rate.
2. For three minutes: Have two students remain at their desks, two walk around the room at a moderate pace, and two hop in place.
3. At the end of three minutes, have each student once again take their pulse and record it.
4. Compare the differences.
5. Repeat the exercise until all students have participated.
6. After the class has rested and pulses are back to lowest rate, have everyone count their pulses again and record them.
7. Have students do 25 "jumping jacks" and take their pulses again.
8. Compare the differences.

GRADE 5, UNIT II, LESSON 1

Title: Energy Flow In My School

Purpose: To recognize the "ins" and "outs" of a school's energy

Materials: Poster board

Procedure:

1. Identify energy uses in your school.
2. After identifying the uses of the school's energy (electricty, gas, water, food, etc. - don't forget student and teacher brainpower!!), assign individual students to make appropriate signs to represent incoming energy.
3. Then have other students make signs to represent where the energy goes or is used; such as heat, lights and student and teacher power.
4. Students should recognize the uses and changes in energy as it passes through the school system.

GRADE 5, UNIT II, LESSON 1

Title: Energy Flow In My School

Purpose: To create an awareness about various places and people who are energy consumers in the communities where students live

Materials: Map of your community

Procedure:

1. Bring a map of the community where students live to class or have the class design a map. Ask students to locate their school on the map. Mark the place for them. Also have them locate generally where they live, or where they go to church, or where a local restaurant or another common point of reference is. Show them that the map outlines the places that are contained within their community. Normally, communities have names. Even if you are part of a central city, you have a familiar section which defines your community. Show students the boundaries of the particular community in which they live. Ask them for ideas about what buildings are part of their community and what people are part of their community as you have drawn it.

2. Draw and use pictures of a school, family, recreation center, factory, and government building to help students explore the idea of community. Tell them that a community is a city or a town, or a part of a city where people act together in doing things. Tell them that the pictures show them parts of the community that are important parts of their everyday lives. Discuss with them what buildings are shown in the pictures, what people are shown in the pictures, and how they contribute to the community.

    a. School. There are probably several schools in your community. You might want to point them out on the map that you have made of your community. Students should see that it is a school, and that schools involve people such as students, teachers, principals, and parents from the community acting together. They work together in order for students to learn things that are important to them in their everyday lives.

    b. Family. Families are very important parts of communities. There are probably many families in your community. If students have located where they live on the map, they can see how many families comprise the community. Families work together in order to contribute to the community. They live there, often work together, and often play together, as part of community life.

    c. Recreation Center. Recreation centers are also important parts of communities. Locate some nearby centers on your map. They involve students, parents, and other community members in social activities, sports events, and community meetings. In many cases, recreation centers have been at the heart of community life.

    d. Factory. People also work in communitites. Many people work in factories; others work in small businesses. These places are the support for the community. If most people could not work, they would not live in a particular community. They may also work outside of the community itself. Locate some factories and businesses on your map.

    e. Government. All communities have governments. Governments make laws that people must obey. Without a government, community life would be very disorganized. Locate the city/town hall on your map.

3. Talk with students individually about how those places and people contribute to the life of their community.

   Have students bring their own pictures about places and people in their community, and then make a collage that represents how their community is seen by students.

4. Explain to students that every community uses energy much like their homes use energy and their schools use energy. Their whole community uses a lot more energy.

   Explain to students that people are the main energy users in any community. People make choices about what they will do. Every time they decide to drive a car, for example, they decide to use energy. One chief way people use energy is in driving cars. People drive cars many places: to work, to school, to a baseball game. Cars use gasoline. Gasoline is refined from oil. The second main way people use energy is in the home. Homes are a major energy consumer because cooling, heating, and lighting are important parts of living at home. Have students find some places where cars go on major streets and where homes are on their map of their community.

   Put the words "community energy" on the board or on big sheets of paper, and list under it "people drive cars" and "people live in homes" as major users of energy. Have students give examples of how people use energy by driving cars and by living in homes that use energy.

5. Now talk with students about a study they can do as a class. Indicate to them that cars are major consumers of energy in communities. They can study the use of gasoline energy by finding out some things about how their family, relatives or friends use their cars. Indicate to students that they need to find out one thing which will contribute to the study. They need to determine for any one day (or the weekend, time between the time school ends and the time class begins the next day, or two days, etc.) the following thing:

   > How many miles did their family, relatives, or friends drive using their car?

   Have students bring the mileage figures to class. You need to do some calculations in order to make these figures meaningful to them. The purpose of the activity is to show students how miles relate to dollars. It is not the purpose here to teach students the calculations. In order to prepare for the class activity, use the following figures for calculating the cost of driving a car.

   1. Miles driven = 100 (hypothetical)
   2. Miles per gallon = 18 (national average)
   3. Gallons used = 5.5 gallons (divide 1. by 2. or 100 by 18)
   4. Cost of gasoline = $1.35/gallon or prevailing price.
   5. Total cost = (multiply 3. by 4.)

   The formula for computing total cost can be stated as follows:

   Miles Driven ÷ Miles Per Gallon = Gallons Used
   Gallons Used × Cost of Gasoline = Total Cost

You can use the averages for number 2 and 4 or you can use actual figures from your community.

6. Work with students to determine how much gasoline the class uses during the time period that you have selected. Tell students you are going to do a study in gasoline use by cars belonging to families, relatives, or friends in your classroom. Then put two phrases on the blackboard. The first phrase should be "number of miles." The second phrase should be "total cost." Now have each student report to you how many miles their family, relatives or friends drove their car. These should be put together in a list that can be added by you or by the students for a total. Put the total under the phrase "number of miles." Students should see that the class as a whole used the cars a lot more than any one student.

   Now tell students that gasoline is used up according to how many miles are driven. Tell them gasoline costs a lot of money. Now calculate the cost of gasoline used by the students according to the previous formula. Write the total on the board under the phrase "total cost." Students should be amazed. Now conduct a class discussion using the following questions.

   a. How many miles did the class as a whole use the cars?
   b. What was the total cost of the gasoline energy that was used by the class?
   c. What would happen if we drove many fewer miles in cars? (You might suggest half the amount under the phrase "number of miles" or 100 less miles, etc.) (Answer: The cost would be much less and we would save energy.) You might want to calculate the savings by subtracting the number of saved miles in number one and follow the formula.
   d. In what ways might we save on the gasoline energy that we use? (i.e., walk instead of ride; use the car together instead of individually)

7. Ask: Who else uses gasoline in your community? (e.g., people who drive buses or trucks, motorcyclists, boaters, farmers on tractors) Go back to your map and help students to identify the major places in which gasoline energy is used. (highways, farms) Have someone who drives a lot (e.g., the school bus driver) come in and talk with students about how important gasoline is to his or her job. Focus on ways that gasoline is used, ways it might be saved, and what would happen if there were no gasoline.

8. Summarize what the students have done in terms of community energy. Ask them what they know about the largest energy consumers in their community. They should quickly tell you that

cars and homes are major energy consumers. Then have students think about ways they might save energy. Have them try out one of these ways for one week as part of a class project. Ask students during that week how they are making progress and why they think that saving energy is important.

GRADE 5, UNIT II, LESSON 2

Title: Make A "Sense Chart"

Purpose: To have students become aware of the five energy senses

Procedure:

1. Divide students into five teams representing sight, sound, smell, touch and taste. It is not necessary to have the same number on each team.

2. Write the five sense words across the top of the chalkboard.

3. Have students line up several feet from the chalkboard, each team facing one of the words.

4. In relay fashion have the students go to the board to write down "Enerwords" pertaining to their team's energy sense. The winning team is the one listing the most acceptable Enerwords in a given time.

Title: A Food Energy Chain

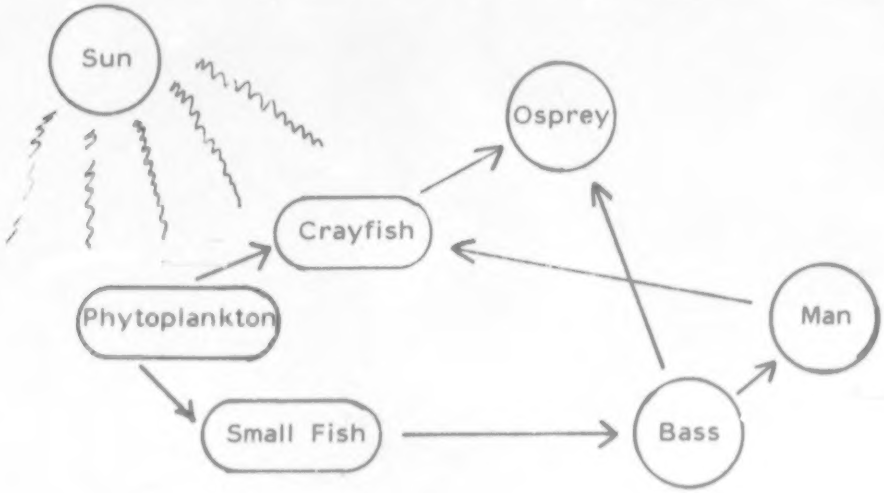
Purpose: To show that all food chains start with the sun

Materials: Individual copies of the following information and food chain

Purpose:

1. Say: The beginning link of a food chain is started by a producer. Plants are the only producers. The arrow in the food chain picture shows what "is eaten by" what. The arrow always points to what is doing the eating, the consumer. Consumers cannot make their own energy so they must get their energy in the form of food from other animals or plants.

   The following food web is one that would start in a pond or lake.



   Definition: Phytoplankton - microscopic plants

2. Have students explain food chain

3. Have individual students represent a figure in the food chain. Use lengths of string to connect a figure in the food chain that affects other members in the chain. (The sun should have a length of string going to all other figures.)

GRADE 5, UNIT III, LESSON 2

Title: People Store Energy

Purpose: To show energy can be stored and used when needed

Materials: Flashlight and batteries, candle, matches, strip of dried bread

Procedure:

1. Flashlight - Empty of batteries

   Flick switch on and off several times to show that nothing happens. Place batteries in the flashlight. Flick switch to "on."

   Ask:

   a. What happened? (Light was produced.)
   b. How? (Batteries - cells - made electricity, and the electricity produced light.)

2. Light the candle

   Ask:

   a. What is produced? (heat and light)
   b. What produced the heat and light? (the wax)
   c. Where does wax originate? (bees or plant oils or paraffin oil)

3. Burn the strip of dry bread

   Ask:

   a. What is produced? (heat and light)
   b. What produced the heat and light? (stored energy of wheat)

Title: The Sun's Energy Affects People

Purpose: To show how the sun supplies most of the earth's radiant energy

Procedure:

1. Have students fill in missing words.

   In the beginning, the ______ bombarded the Earth with ___________ ___________. ___________ "captured" much of this radiant energy and converted it into food energy for growth.

   When these plants died many of them were converted into the three energy-rich fossil fuels: ______, ______ and ____________________.

   ______ are a present-day plant fuel source.

   Words to use:
   coal
   trees
   radiant energy
   plants
   natural gas
   sun
   oil

2. Have students illustrate the processes involved in the creation of fossil fuels. (using the information in procedure 1.)

3. Research and compile information about the creation of fossil fuels.

4. Create a mural illustrating the creation of fossil fuels.

Title: Green Plants Use The Sun's Energy

Purpose: To show that green plants use solar energy to make food

Materials: Corn starch, iodine solution, 125 ml beaker half filled with alcohol, 250 ml beaker half filled with water, source of heat, two plants (one kept in the dark for 24 hours, and one that has been kept in the sunlight for 24 hours), petri dish

Experiment:

Chemical energy in plant leaves is often stored in the form of starch. You can determine whether or not plants need sunlight to produce starch by doing the following experiment.

Procedure:

1. Drop some iodine on a small bit of the corn starch. The blue-black color is a positive test for starch.
2. Select one leaf from the two different plants. Mark them in some way so you will know which plant each came from.
3. Place the large beaker on a source of heat.
4. Place the two leaves in the small beaker containing alcohol and place this beaker into the large beaker.
5. Remove the chlorophyll from the leaves by leaving them in the alcohol until they turn white.
6. Wash the leaves with water, then dip them in a dish of iodine solution.

Results:

1. What happened to the color of the leaf kept in the light?
2. What happened to the leaf left in the dark?

Title: My "Dream World"

Purpose: To help students differentiate between absolute needs and their desire for something more than basic needs

Materials:
Cracker with a piece of cheese
glass of water
pillow
toy car (representing a real car)
electric radio
electric hair curler (or small dryer)

Procedure:

1. Select six students. Tell the students they are each a member of the group of people that live in poverty, isolated from other people.

2. Have the first student select one thing from the items listed under "materials", the second student would then select one of the remaining items, etc. (There is a possibility the last two or three students will not want a choice.)

3. Have the students explain why they did (or did not) make the selection that they did.

Title: My "Dream World"

Purpose: To have students value energy and apply their values to decision-making about energy alternatives

Objective: Students will acquire valuing skills in making energy decisions.

Procedure:

1. To help students acquire basic valuing skills in making energy decisions:

   a. Talk with students about how some things are valuable to them. Some things they can see, such as money or a new bicycle. Other things are less obvious. Some people value friendship. Others value truth. Have students make a list of the things they think are valuable in their lives.

   b. Talk with students about how things are valuable because they have values, or principles or ideas that they live by that are important to them. Ask students to create their own list of values, of ideas, which they think are important in guiding their lives. Their list might include democracy, friendship, truth, justice. Have students feel free to create as long a list as they want that identifies their important values. Discuss with students how their values may conflict. Make a list on the chalkboard of the things students have listed.

   c. Talk with students about how energy also involves values. Making a decision to turn off lights or not to use heat involves basic values about saving, about sharing with others, and basically, about truth, friendship, and democracy. Have students make a list of the values they think are involved in making decisions about energy. Put this list on the board next to the list that they have made in Activity b.

   d. Now have students gather information about energy from newspapers or magazines. For the stories or the pictures they gather, have them indicate which values they think are important in the issue or problem or situation that is being described.

2. Bring someone into the class who can talk with students about energy problems and the basic values that they think are important to saving energy.

3. Ask students to collect or draw cartoons depicting an energy problem and the basic values involved in solving it.

4. Tell students that the principal way in which values become involved in action on energy issues is in making decisions. Every

time a decision is made, a choice is made between different ways of doing things. For example, in turning out the lights or leaving them on, students make a basic decision. If they turn out the lights, it is usually because they are expressing a value, such as saving. If they leave the lights on, they usually are expressing a value which involves seeing, or feeling comfortable, or not caring about spending money or using electricity. Describe for students a situation in which they have a choice as to whether or not to use the lights, and then guide a discussion with the following questions:

a. What values are involved in the use of lights? (i.e., saving energy, helping others now and in the future)

b. How do those values help you choose the way you are going to use lights? (i.e., They are more important than having a lot of light.)

c. How do those values help you see what the outcome of using the lights will be? (i.e., I know I will save energy in accordance with my values.)

5. Divide students into groups, and have each group select a particular issue. The issue might be heat, the use of cars, the use of paper, plastics, or television. Students can pick their own energy-related issues. Have them think about what values are involved in using the energy, how the values help them to choose what they will do with the energy, and how the values help them to see the outcomes of what will happen if they use the energy.

Then hold a class discussion around the following questions:

a. What values are involved in these issues?

b. How did the values help you in making a choice about how to use the energy?

c. How did the values help you to see the outcome of using the energy?

d. Why were one group's values different from or similar to others?

Be sure the students understand that people's values differ and they need to have respect for others' values. When any individual or group makes a choice, it may be based on a different set of values than that of another group. The important thing here is that people realize what their values are and use them as guides in making decisions.

6. Have students outline one thing they think they can do to save energy and the ways their own values enter into decisions they make about their energy projects. Work with students in listing their values that are relevant to their energy problem. Discuss with them whether or not their values are upheld by the activities they have planned. Help them to determine the outcomes of their activities and whether their values continue to be upheld.

Optional:

1. Have students write a story about how they have saved energy and the values that are involved.

2. Talk with students about how values can or cannot be quantified, using the math functions that you are currently teaching.

Title: An Energy Tour Of My Community

Purpose: To give students the opportunity to locate the source electricity for their community

Materials: Individual copies of SOURCES OF FUEL TO PRODUCE ELCTRICITY and POWER STATION TO COMMUNITY (on following pages)

Background Information: Florida imports 90% of its energy sources. Florida has oil fields in the Panhandle near Jay and in South Florida near Lake Okeechobee and the Everglades.

Procedure:

1. Power Station: Have students research and explain the process of producing electricity from coal into electricity to be used at home or in the school.

2. Sources of Fuel: Have students answer these questions?

   a. Is coal found in the eastern United States?
   b. Is oil an important product of the western United States?
   c. Do all states have gas and oil fieids?
   d. Where would you expect to find water sources for hydroelectric plants? Mark them on the map.

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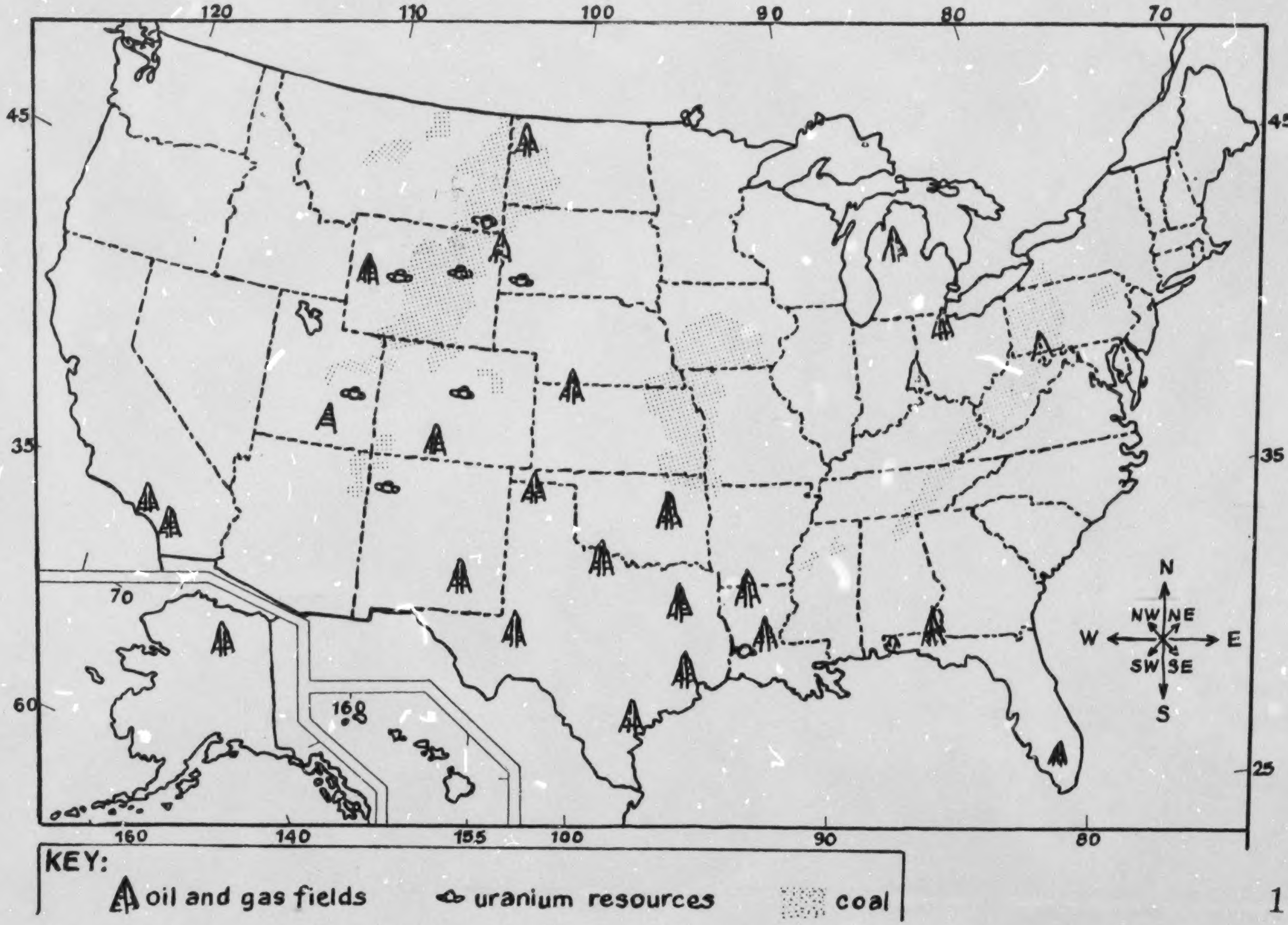
SOURCES OF FUEL USED TO PRODUCE ELECTRICITY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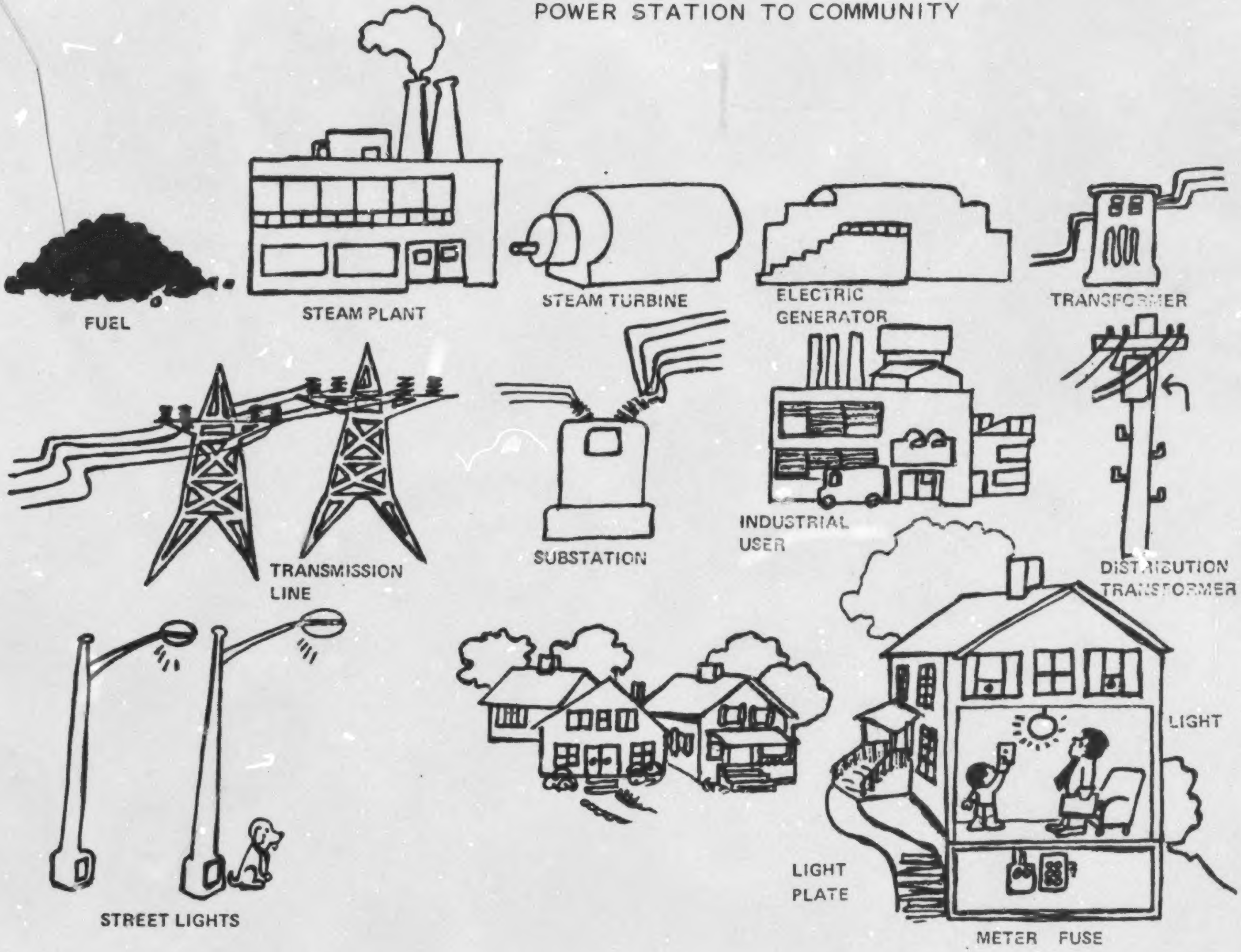
KEY:
oil and gas fields
uranium resources
coal

POWER STATION TO COMMUNITY


FUEL
STEAM PLANT
STEAM TURBINE
ELECTRIC GENERATOR
TRANSFORMER
TRANSMISSION LINE
SUBSTATION
INDUSTRIAL USER
DISTRIBUTION TRANSFORMER
STREET LIGHTS
LIGHT
LIGHT PLATE
METER
FUSE

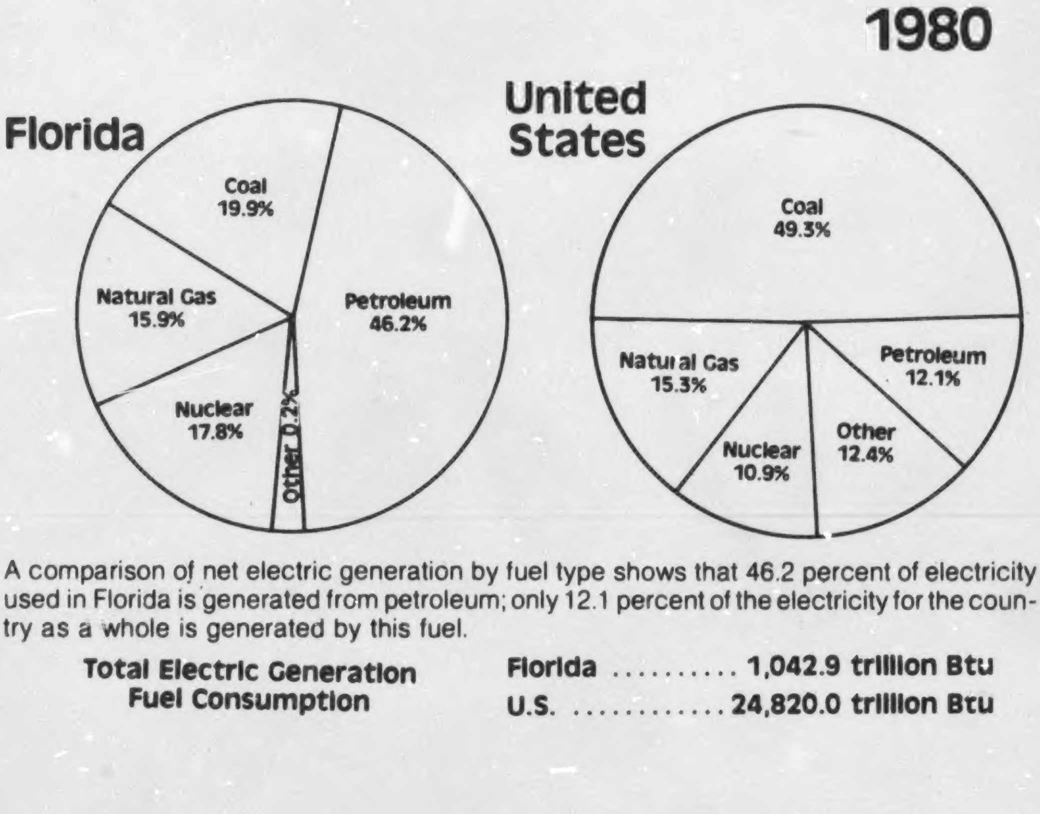
Title: An Energy Tour Of My Community

Purpose: To recognize sources of energy used to produce electricity

Procedure:

1. Copy the circles on the chalkboard and discuss sources of electricity.
2. Look at the circles. Then answer these questions.
    - a. What does each graph show?
    - b. How many kinds of fuel are on the graphs?
    - c. Which fuel is used the most in the U.S.? in Florida?
    - d. Which fuel is used the least in the U.S.? in Florida?
    - e. Write the name of the fuel and the percentage of each fuel used for each graph.
    - f. What is the total amount of fuel used in Florida? in the U.S.?
    - g. Add the percentages for Florida and for the U.S.

MAJOR SOURCES OF ELECTRICITY IN THE UNITED STATES



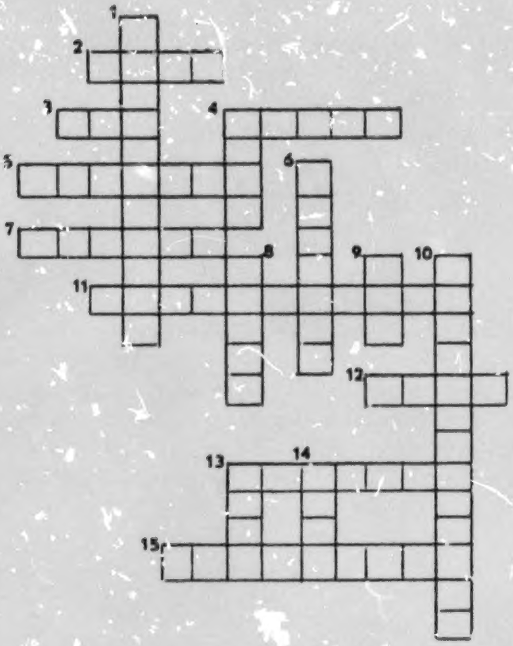
A comparison of net electric generation by fuel type shows that 46.2 percent of electricity used in Florida is generated from petroleum; only 12.1 percent of the electricity for the country as a whole is generated by this fuel.

Total Electric Generation Fuel Consumption

Florida .... 1,042.9 trillion Btu

U.S. .... 24,820.0 trillion Btu

3. Network Word Puzzle



Words to choose from:

coal
electricity
fossil fuels
gas
generator
uranium
hydroelectric
nuclear
oil
turn
steam
turbine
roar
atom
ground
wire
water

Across
2. A black, solid fossil fuel.
3. Air-like fuel.
4. Source of energy in hydroelectric plants.
5. Another name for atomic.
7. Fossil fuels may be found in the ________.
11. Used by people to produce heat and light.
12. An ______ is split in a nuclear reactor.
13. A wheel that turns a generator through use of water or steam.
15. A ______ produces electricity by moving wires through a magnetic field.

Down
1. Coal, oil and natural gas are ________________.
4. Electricity flows through _______s to get to your home.
6. The material used in nuclear reactors is _____.
8. Boiling water makes ___________.
9. A black, liquid fossil fuel.
10. The production of electricity by running water.
13. A turbine ______s the generator.
14. Sound of the water falling near the hydro-electric plant.

Title: Energy Scarcity

Purpose: To develop the children's understanding of the community workers whose jobs depend directly on a source of energy; to identify natural gas as the source of energy; to understand a meter reader's duties; to identify the three basic forms of matter: solid, liquid, and gas; to determine ways in which the meter reader's job is dependent on natural gas; to read four-place numbers and use correct place value sequence

Materials: Picture of a meter reader, drawing paper, pencils, crayons, paper fasteners, scissors, cardboard, ice cube, glass

Background Information:

Fossil fuels are found underground and extracted and burned to relase their energy. These fuels are found in the three states of matter. Natural gas is a gas; oil is a liquid; and coal is a solid.

The motion of molecules causes the changes in the states (gas, liquid, solid). In a solid, the molecules are held together by strong forces. They vibrate but remain in relatively stable position. This accounts for the fact that a solid substance has a specific size and shape.

In a liquid, the molecules are moving faster than in the solid but they are still connected to each other with forces. This increase in molecular motion explains why a liquid has no definite shape, but takes the shape of the container. Since the molecules are connected together with forces, they still occupy a definite volume.

In a gas, the molecules move freely and very rapidly; they have neither definite volume nor definite shape. Heat can change matter from one form to another.

Natural gas is collected from underground deposits by drilling and is transported by pipelines. It is stored in tanks or underground wells. Natural gas is colorless, tasteless, odorless. For safety reasons, a chemical is added to cause an unpleasant odor. The heat it creates when it burns is used to generate electricity, to heat our houses, provide warm water and cook food. Natural gas is a nonrenewable fossil fuel in very limited supply. Recently, it was found that when garbage is buried in a landfill and undergoes decomposition, a by-product of this decomposition is methane gas, the same gas that is in natural gas. This newly formed methane is suitable for commercial or home use. Scientists are working on other ways to make methane from garbage. They also can make it from coal and from animal manure.

The gas is piped into our homes. Meters are used to measure how much we use. Meter readers go to homes and other buildings and read the numbers on the meter. There are several kinds of meter readers - gas, electric, and water. Most meters are found in the basements or on outside walls of buildings.

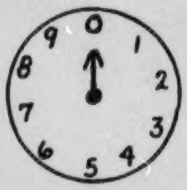
Procedure:

1. Show the children a solid object (rock), a liquid (water) and use air to explain a gas. Write the words solid, liquid, and gas on the board and let the children explain in their own words how these forms of matter are different. Increase interest with the demonstration in number 2.

2. Place an ice cube in a glass. Ask children to predict what will happen to the ice cube. Suggested questions to ask:
   a. Where is the water coming from? (ice cube)
   b. What will happen to the water if it stands in the glass for a long time? (disappear)
   c. How can we make the ice cube melt faster? (heat the glass)
   d. What will happen if we boil the water? (Water will become steam and evaporate - change to a gas.)

3. Explain to the children the change from one form to another happens by adding heat. Develop the lesson further by showing students the picture of the meter reader. Ask questions such as:
   a. What object is the person looking at? (meter)
   b. What do you think a meter tells? (how much gas/oil we use)
   c. What two kinds of fuels do meters measure? (natural gas and oil)
   d. This meter measures natural gas. How do we use natural gas? (to heat water and air; to cook food)
   e. What is the person doing? (reading a meter)
   f. What would you call this person? (a meter reader)
   g. What is a meter connected to? (pipes for gas or oil to gas producer or company)
   h. Why is the person reading the meter? (to report the reading to the gas company so they can determine how much fuel is used and send a bill)

4. Distribute class copies of a cardboard circle. Tell children they are going to make a gas meter. Have each child make a dial like the one shown on the picture. Choose four children to stand side by side holding their dials in front of them to form a gas meter.



5. Have children put all dials at 0. Ask: What would make the dials on your gas meter move? (using gas) Let child with 1's dial slowly turn the dial. Explain that when the pointer gets past 9 it goes to the next dial and that every number on that dial means 10's. Explain that when 99 units of gas are used, it goes to the 100's dial and when 999 are used it goes to the 1000's.

6. Ask which dial would turn fastest (1's dial). Compare it to the minute hand and the hour hand on a clock.

7. Ask the children to read the meter and write the number down. This is the beginning reading. Then have them pretend that it's a cold day and we turn the furnace on and heat water for a bath. What will the dials on the gas meter do? (move or go up) Ask the children to move the dials. Ask one child to be the meter reader and put the number on the board. This is the ending reading. Then have them subtract the starting reading from the ending reading. This number tells them how much gas was used. We can call it the "gas used" number. Let other children be readers, until they all participate. Have each group subtract the beginning reading from their reading. Put these gas used numbers on the board. Then compare the numbers on the board. Ask: What is the highest gas used number? The lowest gas used number? Ask why it is better to have a lower reading on the gas meter? (save money, save energy)

8. Children should make energy worker booklets by writing their own stories and drawing pictures. Encourage the children to show the duties of the meter reader and describe their drawings in words.

9. If the children have gas meters at home, ask them to try to read them on two successive days and report their findings to the class.

10. Classroom Speakers - Often there are people in the community (perhaps even someone in the childrens' families) who know a great deal about a specific subject. Arrange for a telephone person, meter reader, etc. to come to the class and speak about his/her energy-related job.

11. Field Trips - Arrange to take the children on a tour of the school boiler room when discussing the meter reader and/or oil man. Take the class at a time when one or both of these workers will be there to explain his/her specific functions and get first-hand experience at seeing the person at work. Have the children write experience stories following the visit to the boiler room.

12. Arrange for the class to visit a nearby telephone company, power company and/or gasoline station. Help them make a list of things they want to find out.

13. Other energy-related jobs can be similarly included in this unit if accessible to your locale.

Title: Energy Scarcity

Purpose: To discuss carpooling as a method of conserving energy

Procedure:

1. Read this statement to students: John Rich does not like having others ride with him in his expensive gas-guzzling automobile. He says that he will not carpool with anyone because he has plenty of money and does not need to carpool. Will John Rich continue to be rich if he rides alone?

2. Teacher should guide group discussions of these questions.
   a. Do you think it is right for John Rich to be able to ride alone just because he can afford it?
   b. If you feel it is not right for him to be able to use gasoline purely for his own wants, who should tell him that he should not do this.

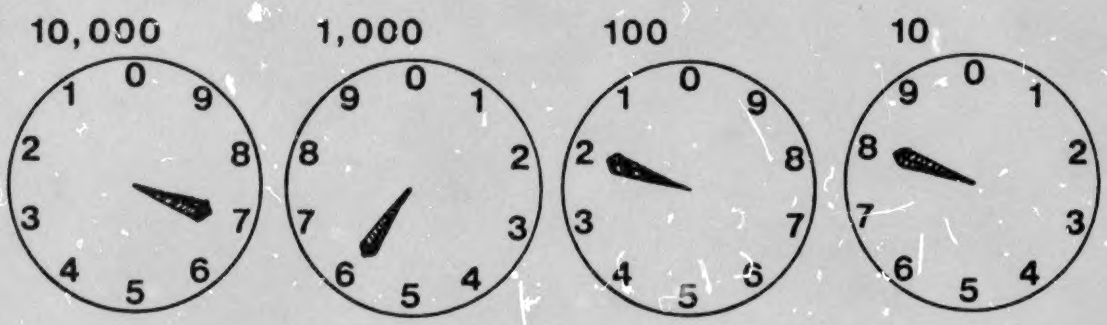
3. Read this statement to the students: The President of the U.S. has decided that the way to keep Americans from using too much gas is to let the price go up as high as it will go. (say as high as $2.00 or $2.50 a gallon)
   a. Do you feel that this is a good policy?
   b. Have six students pick one of the following roles to play and discuss their feelings about the President's policy:

teacher
lawyer
truck driver
farmer
doctor
salesperson

4. Have five students pretend they are advisors to the President. Discuss possible ways to keep Americans from using too much gasoline and then find a policy you all agree on to advise the President to follow.

5. Do the exercises on the two following pages, "Read-A-Meter" and "Tips for How to Save-A-Watt," to stress electrical energy conservation.

Read-A-Meter Exercise Sheet



The four dials on your meter record kilowatt hours. Steps to follow:

1. Write down the number the pointer is pointing to. Your answer for reading the meter above is ________________.

2. To find how much electrical energy you've used in one month, you must take two readings one month apart. Then you subtract.

   Example: November 1 reading: 8262
   October 1 reading: -7628
   Difference ______ Kilowatt-hours used

   Suppose one kilowatt hour costs 6¢. Multiply your answer x 6¢ to find the cost (or obtain current cost from your local electric company).

3. What would you do to find out the amount of electrical energy used in a day?

4. To find out about how much is used to heat or cool your home in a 24-hour period, read the meter at bedtime and again in the morning before other appliances are turned on.

   Example: 6:00 am reading ....
   10:00 pm reading .... __________ Subtract
   KWH used in 8 hours: _____ x 3 = _____ 24 hours

5. Find the meter in the school. Compare school and home meter readings. Subtract. Which uses more energy? Can you think of some reasons why? List them.

Tips For How to Save - A - Watt

Here are some energy-saving tips. Can you think of some other ways to save energy in the following categories?

1. Plug-ins/Other

   a. Turn off lights when not in use.

   b.

   c.

   d.

2. Water Heating

   a. Wash dishes by hand or use the dishwasher only when it is full.

   b.

   c.

   d.

3. Heating/Cooling

   a. In the winter, lower the thermostat at night and when leaving on a trip.

   b.

   c.

   d.

	Estimated KWH Consumed Annually
COMFORT CONDITIONING	
Air Cleaner	216
Air Conditioner (room)	860
Bed Covering	147
Dehumidifier	377
Fan (attic)	291
Fan (circulating)	43
Fan (rollaway)	138
Fan (window)	170
Heater (portable)	176
Heating Pad	10
Humidifier	163
HEALTH AND BEAUTY	
Hair Dryer	14
Heat Lamp (infrared)	13
Shaver	1.8
Sun Lamp	16
Tooth Brush	0.5
HOME ENTERTAINMENT	
Radio	86
Radio/Record Player	109
Television	
Black-&-White	
Tube Type	350
Solid State	120
Color	
Tube Type	660
Solid State	440
HOUSEWARES	
Clock	17
Floor Polisher	15
Sewing Machine	11
Vacuum Cleaner	46

KWH = kilowatt-hour

GRADE 5, UNIT VI, LESSON 2

Title: Florida - A Consumer State

Purpose: To show how Florida and the U.S. depend on imported oil

Materials: World map, duplicate copies of oil import information

Procedure:

THE OIL WE IMPORT

1. Because America's demand for oil is greater than its supply, we must buy oil from other countries to help meet the demand. This is called importing.

2. Have students find each country on a world map. Each country is listed in its proper region below. Beside each country's name, the percentages of oil the U.S. imported in 1978 and 1981 are listed.

	1978	1981
NORTH AMERICA		
Canada	6%	7.4%
Mexico	4%	8.7%
LATIN AMERICA		
Venezuela	8%	6.6%
Caribbean Islands	14%	13.2%
THE MIDEAST		
Iran	6%	0
Saudi Arabia	13%	18.9%
United Arab Emirates	5%	1.4%
AFRICA		
Nigeria	10%	10.4%
Algeria	8%	5.2%
Libya	8%	5.4%
FAR EAST AND OCEANIA		
Indonesia	7%	6.1%
OTHER OPEC	3%	2.7%
NON-OPEC	8%	15.1%

3. Ask: What do the letters OPEC stand for? (Organization of Petroleum Exporting Countries. The OPEC nations have formed an association to regulate the price they charge for their crude oil.)

4. Ask: What percentage of imported U.S. oil came from OPEC nations in 1978 and 1981?

5. Which country, or group of countries, sold the U.S. the most crude oil in 1978? 1981?

6. Why does the U.S. need to import oil? (Because its demand is greater than its domestic supply.)

7. Check which of these solutions to our energy consumption problem seems workable to you.

____ Increase domestic production of fossil fuels

____ Decrease our demand for oil

____ Develop new energy alternatives

____ Increase oil imports to fill growing demand

____ Stop importing; become energy independent

Other solutions (Could you name some?)

GRADE 5, UNIT VII, LESSON 1

Title: A "Letter To The Editor"

Purpose: To develop decision-making skills

Procedure:

1. Read this story about Carla to students as an introduction to how people help to solve energy problems.

CARLA'S DECISION

Carla is in third grade at Day Elementary School. She likes school. Carla has learned in school that part of the energy problem is the way people use lights. She decided that she would try to change her own ways at home.

Carla wanted to get some information about the energy problem. She talked with her teacher. Her teacher called the local light company. The company told her how much electricity Carla used each day. It was a lot.

Carla then faced a major decision. If she could cut using lights in her room, surely her entire family could help even more. She could sit down with her family and talk about using lights. She could just cut her own use of energy. She could then hope that the family would see how savings could be greater. Finally, she could decide not to bother. After all, no one was making her turn her lights out.

She decided that she would cut her own use of lights, and see whether others might follow her example. She decided that if she tried to tell her family, she would not get anywhere. Her brothers and sisters would not listen to her. She did not want her family to get mad at her.

For one month, Carla carefully used lights in her home. She used the lights only nine hours per week, and cut the family's energy bill by over $4.00. The family became interested in Carla's plan. They began to ask her questions about her use of energy. Soon her brothers and sisters were deciding that they could do the same. Her parents also followed her actions. She helped to conserve energy herself. She had also spread the word to her family through her own actions.

2. Structure a discussion that centers around what energy problem is involved in the case and how Carla tried to solve the problem.

3. Use the discussion of Carla as a base for beginning to teach the students some basic aspects of decision-making. Ask students what decision Carla made. Write the word "decision" on the board. Carla decided, or made a choice, to turn off the lights in her room. Ask students what decisions they have made recently. Write their answers under the word. Ask them if they have made any decisions about energy lately. Put those decisions on the board also. Help students to see that everyone makes some kind of decision every day.

4. Discuss with students these four steps in decision-making:

   a. What do we need to know? Finding out or knowing involves gathering information about the question you have. Every decision-maker must have good information in order to make a wise decision.

   b. What can we do? We do not make a decision unless we decide between at least two different things. That is what a choice is. Generally, the more different things you consider, the more comprehensive and better your decision will be. It may be a decision about whether or not to do something. There are often positions in the middle that involve doing a wide range of alternative activities. Usually, how many alternatives are considered depends upon how much information a person has.

   c. What do we want to do? Choices involve selecting among different things. Students should select among things based on what seems best to do.

   d. What happens when we do it? There is an outcome for every decision, a consequence.

   Students should then discuss these four aspects of decision-making in terms of Carla's decision and how she went about making it.

5. Summarize what students have learned about decision-making and how important it is for solving energy problems.

6. Read aloud the stories on the following pages about Mike, Rosa, and George to show students models of different people solving energy problems. Hold a discussion with students about the models along the following lines:

   a. What is the energy problem here? (i.e., gas, usage, heating)
   b. How did the students find out about the problem? (i.e., talked with teacher, father, etc.)
   c. What different things did the students think about doing? (at least two in every case)
   d. What choice was made? (i.e., to turn off lights, use a window patrol)

7. After reading and discussing the stories, have students write "Letters to the Editor." In the letter, have students identify an energy problem; give reasons why conserving energy is important; and suggest how this energy problem might be solved.

MIKE'S DECISION

Mike is a fourth-grader at North Beach Elementary School. Mike likes to ride his bike. He also is involved in swimming lessons. Mike learned about the importance of saving energy in school. He worried about the amount of gasoline energy used by cars. It seemed as if everybody drove cars everywhere, even if it was just down the street.

He wondered if he could do something about his own use of gasoline. He was too young to drive, but he could do something about family use of gas if he did not ask his Mom and Dad to drive him everywhere.

He talked about the problem with his father. His father said he would help him. For a whole week, Mike and his father counted his use of the family car. When he was being taken to a lesson, or a game, or out for an ice cream cone, he and his father counted how many miles they drove. By the end of the week, he was surprised. He found out that the family actually drove him almost 100 miles per week. There should be some way to cut down on gasoline use.

He then made a decision. He could walk or ride his bike everywhere. He really did not need to have the family use the car. He might decide to walk or ride his bike to a few of the places, and to have his Mom and Dad drive him when it was a longer distance. Finally, he could try to get his parents or neighbors to save on their gasoline use.

Mike decided not to try to change his parents or neighbors. They might not think it was very important. He did think that he could try to walk more.

Mike tried it for a week. He began walking or riding his bike everywhere. He biked to baseball practice. He walked to his swimming lesson. Soon he found that his friends began to walk with him. It was a lot of fun.

Mike liked his decision. His parents were very happy. His friends enjoyed walking and riding bikes with him. They, too, were saving energy for their families.

ROSA'S DECISION

Rosa is in fifth grade at Woods Elementary School. She was learning about the energy problem in her class. She felt that there was a way that the school could help.

She wondered what to do. Rosa decided to talk to her teacher. He said that one of the major ways the school used energy was through heating. Woods School was in a town where it was cold and the heat was turned up to 75-80° in the winter. He said that the heat could probably be cut down. It would save the school a lot of money. People would only need to agree to dress more warmly.

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Rosa thought about the problem. She remembered what her teacher said about cutting down the heating.

She could start a window patrol. Windows were often left open in the school while the heat was on. During recess, doors were often left open while the heat was on in the winter. She could also try to get people to wear sweaters and turn down the heat. Rosa talked with some other students. They made a plan. They wanted the students to patrol the opening of windows and doors.

Rosa took the plan to her principal. The principal agreed. Students in each class were put in charge of the energy use. There were very few windows and doors left open during the winter. The patrol did a good job. The plan worked. The school cut down its heating bill because of the students' energy ideas.

GEORGE'S DECISION

George is a fifth-grader at Central Elementary School. He was learning about energy in his science class. George found that dishwashers were one of the major appliances that used energy.

The dishwasher was used a lot in George's home. The family had five children, and there were a lot of dishes after every meal. They also were about to get a new dishwasher. George talked with his mother. She thought it was a good idea to try washing the dishes and delay getting a new dishwasher. They went to the local appliance store. They found that their dishwasher used a lot of energy, and any new one would use a lot, too.

George wanted to cut back on using the dishwasher, but it was difficult to think of a plan. He could do the dishes, but he did not want that! After all, doing that many dishes every day was going to be hard. He thought that he might ask his sister Alice, who was 14, to help him do the dishes.

He talked to Alice about his plan. Alice was not happy at first. She said she would rather dry the dishes than wash them. She said that she would try it for a week. It if worked out well, then they could do the dishes together. George's mother was very pleased that Alice would help. Maybe they wouldn't need an expensive new dishwasher.

It did work. Alice and George enjoyed doing the dishes. They talked to each other about what had happened at school, and with their friends. Soon, their sister Mary was also part of the dishwashing team. This way, when someone had a game or some other activity they wanted to do, others could do the dishes for them.

George's decision worked. They saved $5.00 that month on their energy bill. Soon, the whole family was helping. They never did get the new dishwasher.

Title: A "Letter To The Editor"

Purpose: To consider more than one view of the energy crisis

Procedure:

1. Create a scenario where the students pretend they are the editor of a professional magazine of an energy-producing company.
2. Prepare a list of as many such organizations or corporations as possible.
3. Have each student first write to one of the companies expressing a public concern on the cost, manufacture or use of the energy.
4. Have the letters shuffled and give one to each student.
5. Now, as editors, they must write a brief editorial answering the concern.

GRADE 5, UNIT VII, LESSON 2

Title: The Search For Energy Affects The Environment

Purpose: To appreciate how it takes energy to produce energy

Materials: Matches

Procedure:

1. Light a match to simulate the lighting of the fires necessary to produce steam to operate an electrical generator.
2. Discuss with students that manufacturing the match requires the use of forests, mines, transportation facilities, factories and human endeavor.
3. Encourage students to give examples of and discuss other uses of energy in the production of energy.
4. Throughout this demonstration and subsequent discussions, point out that the search for, production and use of energy changes men's surroundings.

GRADE 6, UNIT I, LESSON 1

Title: A Calorie Count

Purpose: To develop understanding that food is a source of energy

Materials: Pencils, paper, crayons, seed samples of wheat, oats, barley, rice, corn, millet (each sample of seed in a separate bowl)

Processed cereals: Buckwheat, Grapenuts, Shredded Wheat, Puffed Rice, Cheerios, Cornflakes, Rolled Oats. (Choose three or four from each group if you cannot get them all.)

Procedure:

1. Food energy is found in nutrients. (proteins, carbohydrates, fats, etc.) Energy is released into the bloodstream during the process of digestion. Sugar is released faster than the other food elements, but it is not the most nutritional. Food energy is measured in calories.

2. Ask the children to look at the grains in the bowls. After a few minutes, ask them to describe each kind. What colors are wheat, corn, oats, etc.? How big are the cereal grains? Which are big? Small? What do wheat, corn, oats, etc. feel like? Would you want to eat them? Do you sometimes eat them? Do you know what kind of grain each one is? (Help them to identify each one.) In what form do you eat this grain? (Wait for someone to suggest breakfast cereal, then place breakfast cereal boxes on the table, letting children match each cereal with the grain it is made from.) Most cereal boxes have the grain illustrated. Pictures of grains are shown in the World Book Encyclopedia.

3. Develop the lesson by asking: Do you eat cereal in the morning? Why do you eat it? (gives energy) What other foods give energy? (Let them name several different foods.) When you eat food, do you think about how your body changes it into energy? What do teeth do to food? (break up the food into smaller pieces) Where in our bodies do changes take place? (mouth, stomach) Show me where your stomach is. What happens to food in there? (That's where the food gets changed to chemicals that go to the cells all over your body, where it's changed into energy.)

4. Then say: Find your heart, and feel it beat. You will need to remain very quiet. When you feel it beat, stand up. Conclude this part when most of the children are standing. Then say: Let's do some jumping jacks together. Do at least ten. Now sit down and find your heart again and feel it beat. Is it beating slower or faster than before? Did you use more food energy when you were jumping? When you use up most of the food energy your body has stored, what do you think happens? (You feel hungry, and you know it's time to eat again.)

5. Pass out newsprint folded in half, crayons, and pencils. Say: Think about your favorite food. On the left side of the paper, draw a picture of yourself eating your favorite food. On the right side of the paper, draw something you can do with the energy from that food. (run, jump, etc.) Write a story about your pictures. (Use the pictures for a bulletin board or language experience chart, or let the children take them home.)

GRADE 6, UNIT I, LESSON 2

Title: "Power"

Purpose: To identify three forms of energy and explain some of the ways energy is used in the school

Materials: Paper with one or two lines at the top and bottom, and space for a drawing between, pencils, crayons

Procedure:

1. In advance of the day's lesson, arrange with the school custodian for a suitable time to visit the boiler room. Plan with the cafeteria staff for an appropriate time to visit the kitchen. You may wish to arrange for a class visit to the school office and school library.

2. Prepare your children for any of the trips you take around the building. These places may be visited in any order. Be sure the children know they are to look for places where energy is being used. What you see will depend on your particular school building. Have them watch for things that produce motion, heat, or light energy. You may choose to use one or more of the following trips:

   Boiler Room -- Children should notice the furnace and the hot water heater, water pumps and air blowers. Energy forms are heat, motion, and light.

   Cafeteria -- Children should notice the ovens (heat), refrigerators (heat/cool), dishwasher (heat, motion), mixer (heat, motion), slicer (heat, motion), etc.

   Library -- movie projector (heat, motion, light).

   Office -- electric typewriter (motion), bell system (sound, motion), fluorescent lamp (light).

3. Following the trip, ask the children to choose three things they saw on the tour that showed three forms of energy being produced - heat, light, and motion. Draw pictures illustrating these three things.

4. Make up some riddles to recall some of the energy users seen on the tours:

   a. In the office we saw something that was on a desk, moved and used electricity. It was a _______________. (typewriter)
   b. In the library we saw something that used a light, had two spools that moved and used electricity. It was a ________. (projector)
   c. In one room we saw something that uses oil and gives off heat. It was a _____________. (furnace)
   d. We saw something that gives off heat energy, has a light in it and uses electrical energy. It was an _________. (oven)
   e. We saw something that has a round base, that twirls around and uses electricity. It was a ________. (floor polisher)
   f. We saw something that uses electricity and makes a noise. It was a ___________. (bell)
   g. We saw something that was rectangular, uses electricity and makes things cold. It was a ____________. (freezer)

GRADE 6, UNIT 1, LESSON 2

Title: "Power"

Purpose: To create an awareness of current reference materials on energy and to develop organizational skills

Objective: To help students focus on the "What, Where How and Why" of four selected energy sources as they explore reference materials and become aware of available energy sources.

Materials: Mini-packet on "How's Your Energy?" Students will locate their own reference materials.

Procedures:

1. Have students complete mini-packet.

2. Say: Most of us use the word ENERGY every day of our lives. I have just lost all of my ENERGY. There is supposed to be an ENERGY crisis. The sun's ENERGY is warming the air. Our house is designed to save ENERGY. We all use the word but do we all know what we are really talking about? What is ENERGY, and where do we get it?

3. Say: Using reference books such as textbooks, encyclopedias, dictionaries, magazines, etc., do the following exercises to the best of your ability. The total packet is worth 100 points and will be evaluated as follows:

   - o 20 points - introduction
   - o 60 points - research - 15 points for each source
   - o 20 points - experiment, demonstration or drawing used to show how one of the energy sources is available to mankind.

4. Say: We use several forms of energy each and every day of our lives. Write the definition of energy as stated in four different reference books. List the book, its copyright date, and the definition.

5. Say: According to the thinkers of our day, all matter in the universe contains energy. Albert Einstein suggested that the relationship between matter and energy is a very close one. In fact, he suggested that one day we will understand how to convert matter into energy and energy into matter. This sounds good to most people, but just what is matter? List at least six different forms of energy that might be available to you on a daily basis.

6. Have students write the definition of matter as stated in three different reference books. List the book and its copyright date with the definition.

7. Say: Using your definition of matter, list at least five forms of matter that you came in contact with on your way to school this morning.

   If all the matter listed contains energy, and the energy is not doing some work (causing something to move), then it must be stored energy. We call this ______ energy. The matter which came in contact with that which was causing something to move or do work can be said to possess __________ energy.

HOW'S YOUR ENERGY?

RESEARCH

It becomes clear that our lives are dependent upon many forms of energy to help us do work. We drive cars, heat our homes, light our schools, grow our food, and in general use it for survival and convenience. In almost all cases, this energy is not readily available in the form we can use. For example, we cannot pick up a sunbeam to run a fireplace. Other than direct solar energy, energy to heat your room is locked up in wood, coal or petroleum. As intelligent human beings, we have been able to take this potential energy and convert it into kinetic energy to serve our needs. We are the only animals on earth which have been able to do so.

GRADE 6, UNIT I, LESSON 2
(Continued)

One form of energy used by man is in the form of heat. Heat keeps us warm, moves our motors and machines, make our meals, and provides us with artificial light. (electricity)

In the remaining protion of this lesson, we will explore some potential sources of heat energy that are available to the world's human population.

Select four potential sources of heat energy used by people, e.g., coal, peat, natural gas, oil, etc. Research each heat source. Be sure to list reference, author and date the article was presented.

1. What source of potential energy are you investigating?
2. What is the energy used for?
3. What percentage of the United States energy is supplied by this source?
4. Where can this energy be found in greatest abundance?
5. Where does the United States obtain this source of energy?
6. Where are the waste products used, stored or gotten rid of?
7. How do we collect this energy?
8. How efficient is this energy as a source of heat?
9. How is this energy stored for later use?
10. How much energy is remaining for our future use?
11. Why is this a good source of energy?
12. Why is this a poor source of energy?
13. Why isn't this source of energy used more extensively?
14. Why are we concerned about the future use of this energy source?
15. In your opinion, will we be using more, less, the same amount of this form of energy in 1990?

DEMONSTRATION

Pick one of the four sources of potential energy researched and demonstrate either with an experiment or with a drawing how that energy is made available for man's use. Demonstrations in which quantitative data are presented will be valued more than simple illustrations of principles.

Title: "Power"

Purpose: To recognize the many forms of power

Procedure:

1. Take a few moments to allow students to brainstorm how many kinds of power they can name. Include actual types (electrical, wind, solar, etc.) and descriptive types. (noise, brain, slow, etc.)

2. Have each student demonstrate, in turn, a type. Then have the students assemble in various groupings (e.g., manmade, natural, human, industrial, Florida, etc).

3. As a grand finale, have everyone do their thing at the same time!

Title: An Appliance "Energy Chain"

Purpose: To perform a physical demonstration of the relationship of energy and ordinary appliances

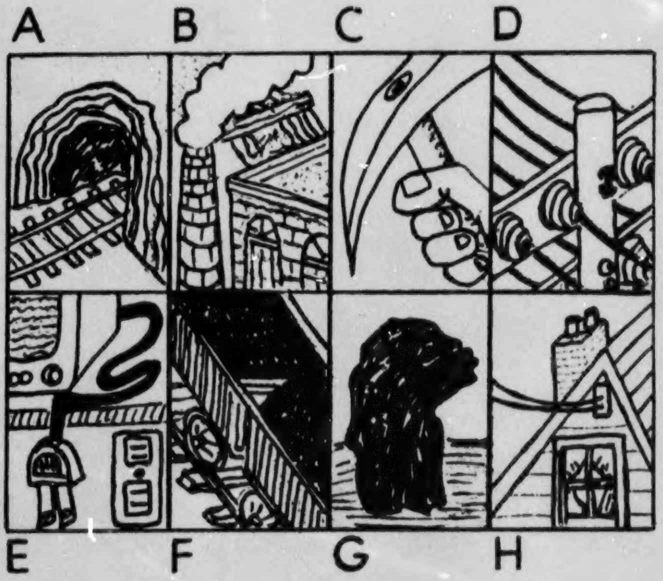
Materials: String, poster board, felt pens, duplicated copies of Did You Ever Wonder Where Your Electricity Comes From?

Procedure:

1. Have students choose a common household appliance they will use for this activity.
2. Using signs, identify one student as the appliance, others as the raw materials, production, transportation and marketing systems.
3. Have some students identified as energy types. (electricity, diesel, water, etc.)
4. Then use the string to connect the related components; this should result in a complex web.
5. Show the processes involved in getting electricity to you for your appliances.

DID YOU EVER WONDER WHERE YOUR ELECTRICITY COMES FROM?

STEP 1. ____
STEP 2. ____
STEP 3. ____
STEP 4. ____
STEP 5. ____
STEP 6. ____
STEP 7. ____
STEP 8. ____



ANSWERS: 1.C 2.G 3.A 4.F 5.B 6.D 7.H 8.E

GRADE 6, UNIT II, LESSON 2

Title: Concentrated Energy

Purpose: To discuss some forms of energy and how they change

Materials: charcoal briquets, pie plate filled with sand, tongs

Procedure:

1. Either pass around or display some charcoal briquets. Generate discussion on what kinds of energy it represents and how this energy is produced from wood.
2. Hold a charcoal briquet with tongs (over sand-filled pie plate) and light with a match. Watch it burn. Discuss.

GRADE 6, UNIT II, LESSON 2

Title: Concentrated Energy

Purpose: To understand how energy is converted from one form to another

Background Information: Energy is a fixed commodity being neither created nor destroyed, but converted from one form to another. The means of conversion are important.

Procedure:

1. During the consideration of how energy is converted from one form to another, arrange to take the class on a "field walk."
2. Students, working together in groups of two or three, should be challenged to list all the energy conversions they can see or hear during a 15-20 minute walk.
3. Ask each group to list their findings as follows:

Object Viewed or Heard	Energy Source	Conversion Product
Moving automobile	Gasoline	Motion
Moving cloud	Wind	Motion
Neon Sign	Electricity	Light
Siren	Electricity	Sound

4. Ask each group to share its list with the class and develop on the chalkboard a master list of group findings.

   a. How many examples were reported by every group?
   b. What type of energy source predominates?
   c. What type of energy product is most common?
   d. Is electricity a "primary" or "secondary" energy source?
   e. What intermediate conversions might occur between an energy source such as gasoline in an automobile, and the motion of the vehicle?

GRADE 6, UNIT III, LESSON 1

Title: Heat Is Lost

Purpose: To identify the essential element of heat loss

Materials: Candle, matches, 4-6 thermometers (0-50°C), tape, 1 water glass and styrofoam cup of equal size, magnifying glass

Procedure:

1. Light the candle. Hold the candle near the door and windows.
   a. What does the flickering represent? (air moving)
   b. What can be done to the door and windows to prevent escape of heat? (weatherstrip, caulk)

2. Attach thermometers, near ceiling, floor, by a window, door and on an inside wall and an outside wall. Record the readings.

	9:00	11:00	1:00	3:00
Ceiling				
Floor				
Window				
Door				
Inside Wall				
Outside Wall				

   a. Where is the room warmest?
   b. What is the coldest location?
   c. How is the heat moving around the room?
   d. How can window temperatures become warmer?

3. Have a small group of students put equal amounts of hot water in an ordinary glass and a styrofoam cup. Take the temperature of water in each. Place pieces of cardboard over each container to insure heat loss is through the container, not the opening.

4. After 1 minute, record the temperature of water in each container.
   a. In which container did the water stay hotter?
   b. Why?

5. Ask students to examine bits of styrofoam cup with a magnifying glass and tell what they see. (air pockets) How can air pockets keep heat in? (Air cannot carry heat away if it is trapped in the pockets.)

GRADE 6, UNIT III, LESSON 2

Title: Energy Inventors

Purpose: To relate past and present uses of energy to our future

Procedure:

1. Have students research and discuss inventions that have shaped our present society.
2. Ask each student to think of something that hasn't been invented yet.
3. Have students prepare a paper about how their invention will use energy, conserve energy, and how it will affect the environment.

GRADE 6, UNIT III, LESSON 2

Title: Energy Inventors

Purpose: To compare energy sources of an earlier time with those of today

Procedure:

1. During a study of pioneer life, attention will be given to how food, clothing, and shelter were provided at that time. It should be pointed out to children that the energy sources used to do most of the work in the pioneer family unit were (1) human muscle, (2) animal power, and (3) wood.
2. Divide the class into three groups: food, clothing, and shelter. Ask each group to research through reading and interviews how each basic necessity was produced in pioneer times before electricity was available. Ask each group to research how electricity is used today to produce the food, or clothing, or shelter we use.
3. Ask each group to summarize its findings to the class and indicate what changes we would need to make in the way we live if we had no electricity.

GRADE 6, UNIT IV, LESSON 1

Title: The Sun Affects Our Climate

Purpose: To learn about the sun as a source of energy

Materials: Box of cereal, two plants of the same kind

Background Information: The sun is a primary source of energy for all plants on earth. Plants use energy from the sun to combine minerals from the soil with carbon dioxide from the air to make starches and sugar. The process is called photosynthesis. Today we can collect the sun's energy in photocells or in glass-covered boxes that are blackened inside. The photocells convert the sun's energy to electricity. The energy absorbed in the glass covered boxes (called "solar panels") can be used to heat water flowing over them in pipes or tubes. This hot water then can be stored for use, or used to heat a home.

Procedure:

1. A week in advance of the lesson, put one plant in a dark place and a similar one in the light.
2. Hold a box of cereal before the class. Say: I saw on TV a commercial for breakfast cereal. The announcer said that this breakfast cereal could give me energy. How could a breakfast cereal give me energy?
3. Another way of proceeding is to ask the children who have pets at home to stand. Ask: Do animals also get energy from food? (Call on each child who is standing.) Ask: What kind of pet do you have? What do you feed your pet? How does your pet use the energy in the food?
4. Discuss the following key questions:
    a. If we get energy from food, and animals get energy from food, how do you suppose plants get energy?
    b. Are plants living things?
5. Say: The sun gives light energy which is used by plants.
6. Place the two plants in front of the class; the plant that was grown in the light and the one grown in the dark. Explain where each had been growing. Have the class observe differences. (The one grown in the dark is likely to be taller and a lighter color, whereas the one in the light will be a healthy green color and bushier.

7. Compare the conditions for growth of the plant grown in the dark with the one in the light. Bring out the fact that sunlight made the difference. Sunlight is necessary for the growth of most plants. We get light from the sun.

8. Say: We also get heat from the sun. Did you ever get sunburned? If so, where did the heat come from?

9. Find other examples to show that the sun is a source of heat. Go outside and touch a wall that the sun is shining on. Now touch a part of the wall made of the same material but in the shade. Which is hotter? Use thermometers to measure the temperature of the parts of the wall in the sunlight and in the shade. Compare.

10. Block one pane of glass with black paper so that the shadow falls on the window sill. Put one hand on the sill where the sun is shining and the other in the shaded portion of the window sill. Which is warmer? Why?

11. Make a class story giving some facts you have learned about the sun. The following are basic facts:

OUR SUN

THE SUN GIVES LIGHT.
THE SUN GIVES HEAT.
PLANTS NEED SUNLIGHT IN ORDER TO GROW HEALTHY.
PEOPLE AND ANIMALS NEED SUNLIGHT.

GRADE 6, UNIT IV, LESSON 1

Title: The Sun Affects Our Climate

Purpose: To determine that water is important to all living things and that solar energy can be used to collect water

Materials: Light plastic sheeting about 4 ft. square, pieces of cactus or any moisture-collecting plants, jars or cans, shovel

Procedure:

1. Choose a sunny day for building a solar still.

   a. Dig a hole about 3 ft. across and about 1½ - 2 feet deep in a sunny and moist place.

b. Place the large pieces of cactus in the hole.

c. In the center of the hole, place the jar or can.

d. Place the plastic over the hole and weigh down the edges with rocks.

e. Place a stone in the middle on top of the plastic sheet above the approximate center of the jar or can.

f. Moisture from the soil or plants will be drawn up by the heat of the sun. Moisture in the cooler air above the plastic will condense. The moisture will collect and run down the plastic to the lowest point where it drips off into the container. 1 to 5 pints of water may be collected in a day.

2. Write a story about how it would feel to be able to get only 1 to 5 pints of water a day and what you would do with this small amount of water.

GRADE 6, UNIT IV, LESSON 2

Title: People Worship The Sun

Purpose: To create thoughts on how we use the sun directly

Procedure:

1. Get the class thinking of ways we use the sun to warm and color ourselves. (Direct exposure is the most obvious, but don't forget solar lamps or even pills or lotions that darken the skin without exposure.)

2. Have the students list things and methods used to "worship the sun," such as goggles, reflectors, suntan products and beach umbrellas.

3. Discuss greenhouses. In greenhouses, glass allows the short-wave radiation of the sun to pass through. When things inside the greenhouse "warm up," they reradiate long waves which the glass blocks. This "greenhouse effect" is why a closed-up car gets very hot inside when it's in the sun.

GRADE 6, UNIT V, LESSON 1

Title: Energy For Transportation

Purpose: To study the effects of friction/resistance to movement

Materials: State road map

Procedure:

1. Say: To conserve energy, it is evident that one must accomplish a task with the minimum amount of work. In the process of doing work, the less resistance, drag or friction one must work against, the less energy is expended.

2. Copy the following problem on the chalkboard: Suppose a car averages 20 miles per gallon of gasoline on long trips when the suitcases are on a luggage rack on top of the car. By putting the luggage in the car (reducing air friction) you get 8% better mileage.

3. Using a map of your state, figure the number of miles from a city on the west side to a city on the east side.

   a. Compute the number of miles per gallon the car would gain with the luggage in the car.

   b. Compute the number of gallons, to the nearest tenth, used in traveling with the luggage: on top of the car; in the car.

   c. Assuming a cost of $1.35 per gallon, determine the money saved on the trip by packing the luggage in the car instead of on the roof.

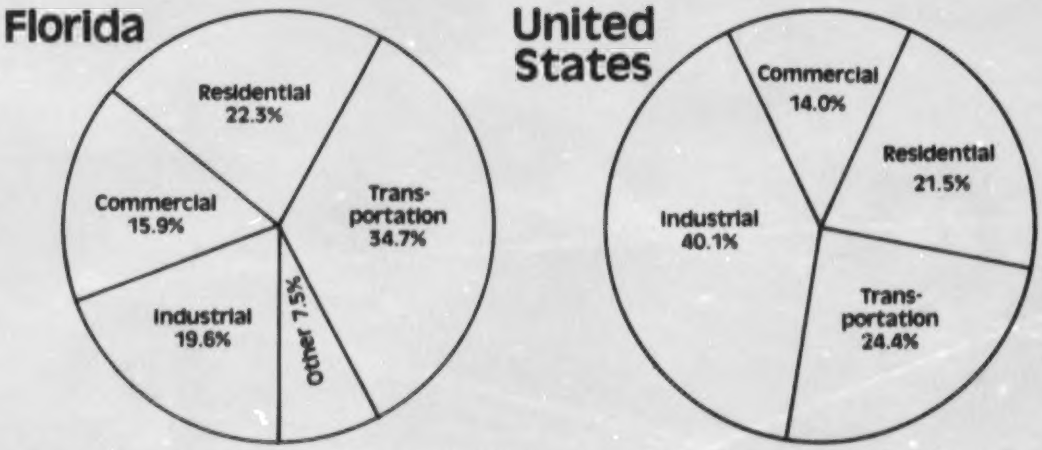
__Title__: Energy Use In Other Nations

__Purpose__: To determine how the United States uses more energy than underdeveloped nations

__Procedure__:

1. Discuss this statement: The United States has but one-sixth of the world's population, yet we consume over one-third of the world's energy. Why?
2. Draw pie graphs on the chalkboard and discuss.
3. After studying the pie graphs, the students should be able to define the items and procedures that are not used in underdeveloped countries but are prevalent in the U.S. and in Florida.
4. Why and how does Florida differ from the U.S. in energy use?

Percentage of Total Energy Consumption by Sector—1980



The consumption of energy in Florida differs from that of the country as a whole. The transportation sector is the largest energy consuming sector in the State. In 1980, transportation accounted for 34.7 percent of energy use in Florida, but only 24.4 percent of the nation's. While over 40 percent of the country's total energy consumption was in the industrial sector, industry accounted for less than 20 percent of energy use in Florida.

GRADE 6, UNIT VI, LESSON 1

Title: A "Do-It-Yourself" Blackout

Purpose: To determine the feasibility of living without electricity at this exact time

Procedure:

1. Prior to doing this activity, have students identify older (80s or late 70s) relatives or neighbors who are willing to answer questions about their childhood. (Perhaps have some of them come to the classroom to act as resource persons)

2. Have students ask the "old timers" how and with what they or their families accomplished the following tasks when they were children.

    1. Cooked
    2. Washed clothes
    3. Dried clothes
    4. Studied or read in the evening
    5. Kept warm in the house
    6. Stored food
    7. Traveled distances

3. Discuss: If our community had a "blackout" for several days, could our families continue their normal way of living? During this period of "blackout," could we manage as the 70 and 80 year olds did in their youth?

GRADE 6, UNIT VI, LESSON 2

Title: A World Without Energy

Purpose: Energy is essential to humankind

Procedure:

1. Have students research the hisotry of energy sources and uses through time.

2. Have students design a mural showing how they think the World has looked and will look as various sources of energy have been used through history and will be exausted in the future. (Include a time line)

GRADE 6, UNIT VII, LESSON 1

Title: Lifestyles And Energy

Purpose: To appreciate how dependent our standard of living is on energy

Materials: Expendable magazines and newspapers, copies of LIFESTYLE SURVEY FORM on next page

Procedure:

1. Schedule a picture-clipping session to have students cut out scenes or items that portray the current scene.
2. Have the students individually create a collage of their clippings or a large mural or poster.
3. As a class project, using multi-colored felt pens, line out those things that would no longer be available as energy sources become limited and then extinct. (Don't forget by-products such as synthetics, medicines, and plastics made from petroleum.)
4. Distribute the "Lifestyle Survey Form" on the following page. To elicit student values regarding electrical appliances and their views of a desirable lifestyle, have students follow directions to describe their feelings about giving up particular items listed.
5. When students have finished, discuss answers given and tally on a master sheet.
6. Discuss results compiled on the master sheet.
7. Assign students to write compositions about how dependent our standard of living is on energy, how their personal uses of energy is determined, and how they feel about making energy-use choices.

LIFESTYLE SURVEY FORM

Place an X in the column that best describes your feeling about giving up a particular item.

ELECTRICAL APPLIANCE OR ITEM*	Do Not Have	Very Easily	With Some Difficulty	With Great Difficulty	Impossible
Radio					
Stereo					
Air Conditioning (at home)					
Air Conditioning (at school)					
Electric Fan					
Clock					
Freezer					
Typewriter					
Copy Machine					
Water Heater					
Power Tools					
Refrigerator					
Iron					
Dishwasher					
Electric Mixer					
Doorbell					
Electric Stove					
Hair Dryer					
Elevator					
Toaster					
Electric Blanket					
Garbage Disposal					
Blender					
Lights					
Clothes Washer					
Electric Guitar					
Telephone					
Sewing Machine					
Trashmasher					
Electric Curlers					
Color TV					
B/W TV					
Electric Toothbrush					
Clothes Dryer					

*Add any other items you may have in your home.

GRADE 6, UNIT VII, LESSON 1

Title: Lifestyles and Energy

Purpose: To have students apply their knowledge of energy and problem-solving to a situation that is important to them

Procedure:

1. Have each student choose a particular energy problem important to them. Discuss the main dimensions of each individual energy problem. Discuss the following questions:

   a. What is your energy problem? (e.g., turning off lights, saving heat, recycling products, driving fewer miles, organizing a community campaign for saving energy)

   b. What actors are involved in your energy problem?

   c. What issues are you trying to solve?

   d. What actions are you thinking about doing?

   e. Why are these actions important?

2. Help students plan how to actually take action on the problem they have defined. Have them use the "Taking Your Own Action" form. Help them to respond to each of the sections of the form. You may want to talk orally about each of these sections and put the answers on the board. Or you may want students to work in groups. They should, through this discussion: define the problem that they are trying to solve; talk about the information they need in order to solve it; list the people who are involved in working on the problem; determine who will do what in tackling the problem; decide at what time each person will take his or her action; and finally, decide on what form the report will take. You should go through each one of these steps with the students and help them to work out a realistic and well-reasoned plan for taking action on their problem.

TAKING YOUR OWN ACTION

My Energy Problem ______________________________

Information I Need ______________________________

Who Will Do Things? ______________________________

When We Do Things ______________________________

Report ______________________________

3. When students are taking action on their problem, you should talk with them regularly about how they are progressing. You may want students to give oral reports to you on a regular basis. You may want them to keep written logs of their activities so that they can remember what they have done. You should be a central stimulus and resource for students as they are carrying out their activities.

4. Have students give reports to the class on their success in taking their own action. They may make these reports in oral or written form, or use visual aids, such as pictures they have made or pictures or articles that have been taken from newspapers or magazines. They can present these reports to other classes in the school or to groups in the community via the P.T.A., newspapers, etc.

5. When students have completed their reports, have the class make a set of recommendations about how people might save energy. Write these recommendations on the board.

6. Have students prepare letters or memoranda to send to the proper people who make decisions in this area so that others may learn to save energy. Discuss the responses that are received in answer to their recommendations.

Title: Energy Waste -- Or -- Conservation?

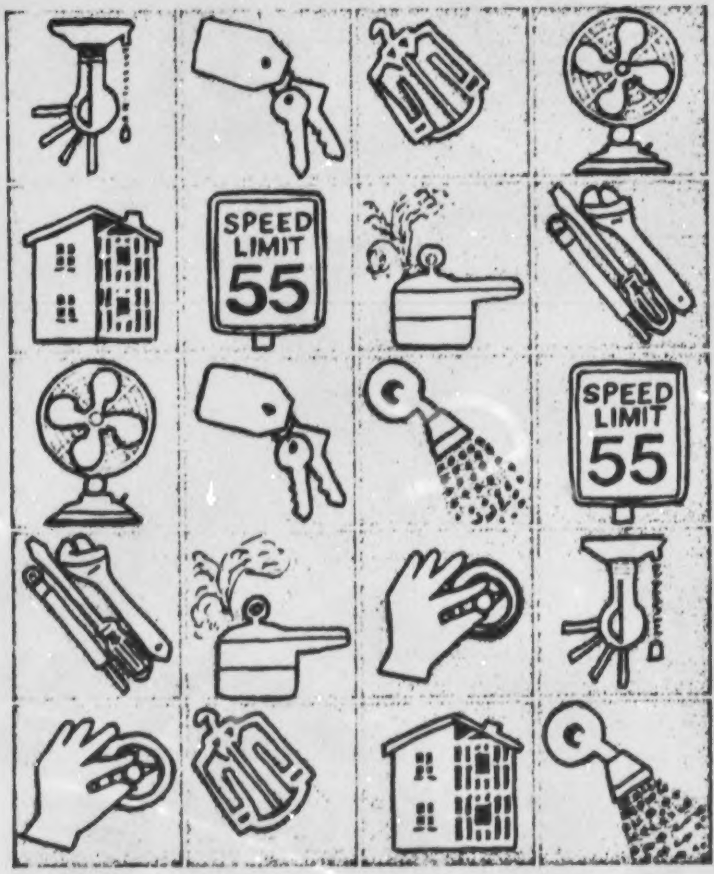
Purpose: To promote conservation by reducing waste

Materials: Energy saver pictures

Procedure:

1. Reproduce the energy saver pictures on heavy paper and then cut out each square.

2. Play a game of "concentration" by shuffling and turning the pictures face down. The players then pick two random squares and attempt to match a pair. When they do (to get a point) they must name a related conservation idea that will reduce waste. Write these down by pair groupings. In subsequent rounds, different conservation ideas must be named in order to get points. Play toward a point or time limit.

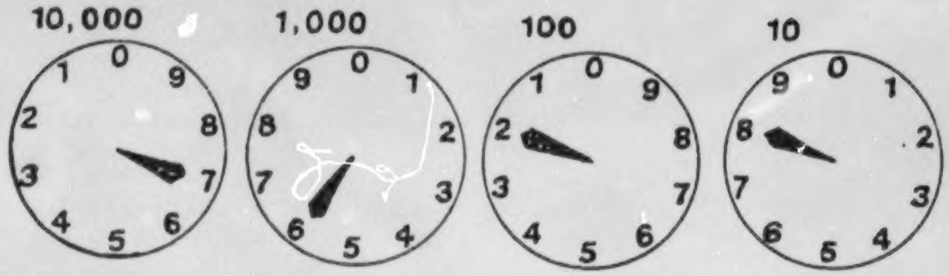


Title: Energy Waste -- Or -- Conservation?

Purpose: To learn how to read electric meters to tell how much energy we use

Procedure:

1. READ LEFT TO RIGHT:



AVERAGE MONTHLY KWH

Range	100	Electric heater	28
Electric Skillet	15	Electric heat pump	760
Toaster	4	Electric heat for house	790
Washer	7	Central air conditioning	808
Dryer	65	Room air conditioning	425
Iron	14	Refrigerator	195
Hot water heater	300	Freezer	178
		TV	150
		Stereo	100

2. If you could only use 1200 KWH each month, what appliances would you use?
3. Locate your electric meter at home.
4. Turn off as many energy users as possible.
5. See how long it takes your meter's dial to revolve 10 times.
6. Turn on a single light and see how many seconds quicker the dial revolves.
7. Do the same with other appliances and make your own chart rating appliances: record player, radio, iron, stove and others.

GRADE 6, UNIT VII, LESSON 2

Title: Energy Waste -- Or -- Conservation?

Purpose: To determine ways to conserve electricity at home and at school

Materials: Duplicated copies of TEST YOUR ENERGY E.Q. and WHAT'S YOUR E.Q.? (on following pages)

Procedure:

1. Have students collect their family's electric bills for three months. Find the number of kilowatt hours (KWH) on each bill. Add the KWH for the three bills. Divide by three.

2. How much electricity does each family average each month? Try to reduce the amount of electricity each family uses. Compare the bills after several months. Do you see any difference?

   Ask: Why should you be concerned about the amount of electricity you use?

3. Have students do exercise TEST YOUR ENERGY E.Q. on the following pages. Discuss questions and answers.

4. Have students suggest ways your school could save electricity. Ask your principal to review your list and comment on it. Can any of these ideas be tested?

5. Have students do exercise WHAT'S YOUR E.Q.? Discuss questions and answers.

TEST YOUR ENERGY E.Q.

Take this quiz to check your knowledge of energy-environment issues.

1. ____ How much of the energy used in gas stoves supplies the pilot lights?

   a. 10% b. 25% c. 50%

2. ____ An incandescent lamp and a fluorescent lamp have the same light output. Which uses energy more efficiently?

   a. fluorescent
   b. incandescent
   c. both about the same efficiency

3. ____ How many soft drink cans can be manufactured from recycled aluminum with the energy needed to make a single can from aluminum ore?

   a. three b. five c. twenty

4. ____ How long would a 100-watt light bulb burn on the energy needed to manufacture one throw-away soft-drink can or bottle?

   a. 10 minutes b. 5 hours c. 20 hours

5. ____ How much of the energy stored in crude petroleum is lost between the oil well and a moving car?

   a. 20% b. 60% c. 90%

6. ____ The heat energy of a gallon of gasoline is equivalent to:

   a. 5 man-days of labor
   b. 15 man-days of labor
   c. 25 man-days of labor

7. ____ How much faster than their rate of production are we consuming our fossil fuels?
   a. 10 times b. 1,000 times c. 1,000,000 times

8. ____ What fraction of the world's energy consumption occurs in the U.S.?

   a. Over 10% b. Over 20% c. Over 30%

9. ____ Which of the following fuel resources is in greatest danger of exhaustion?

   a. coal b. petroleum c. natural gas

10. ____ In the year 2000, American total energy demand will be:

    a. the same as today
    b. twice as much as today
    c. three times as much as today

ANSWERS: TEST YOUR ENERGY E.Q.

Score 1 for each correct answer. 0-5 Poor, 6-7 Fair, 8-10 Good.

1.(c) Approximately half of the gas used in a gas stove is used to fuel the pilot lights because pilot lights burn continuously.

2.(a) Fluorescent lights give off three to four times as much light per watt of electricity used as incandescent lamps do. One 40-watt fluorescent light gives more light than three 60-watt incandescent bulbs and the annual savings may be as much as $10.

3.(c) Aluminum is a very energy-intensive material, with the largest share of the energy going to process the ore. Recycling is a great energy saver. The nation's total throwaway containers' equivalent energy waste is equal to the output of 10 large nuclear power plants.

4.(b) A 100-watt lamp could burn for five hours on the energy used to manufacture a disposable can or bottle.

5.(c) 94% of the energy in the gasoline from crude petroleum is lost in making your car move. The efficiencies of the most important steps where energy is lost are:

producing the crude oil	96%
refining	87%
gasoline transport	97%
engine thermal efficiency	29%
engine mechanical efficiency	71%
rolling efficiency	30%

The total efficiency of the system is found by multiplying the six factors together: 6%.

6.(b) 15 man-days of labor. Said in another way, one barrel of oil contains heat energy equivalent to the energy of a man at hard labor for two years.

7.(c) In less than 500 years, man will have consumed essentially all of the coal, oil, and gas that nature started forming 500,000,000 years ago. By comparison, that same fraction of a calendar year is approximately 30 seconds.

8.(c) More than a third of the world's energy is consumed by the 6% of the world's population residing in the United States.

9.(c) Natural gas reserves in the U.S. are expected to be exhausted in about 40 years. Petroleum should last for less than a century. Coal, 500 years or so if used at the present rate of consumption. The consumption rate of coal is expected to increase rapidly, so coal will probably be scarce in a century or two.

10.(b) For more than a century, American demand for energy has doubled, on the average, every 20-25 years. Now, the rate is doubling in less time.

WHAT'S YOUR E.Q.?

Read each statement. Find its correct answer. Then write the number of the answer in the blank.

A. Slows the movement of heat _____

B. Recommended home temperature in winter. _____

C. Open and close it quickly. _____

D. A quick shower uses ________ the water of a normal bath.

E. Put it around windows and doors. _____

F. Maximum temperature for water heater. _____

G. Insulated drapes can block out ____ of the heat from the sun.

H. Look for it on an air conditioner. _____

I. What every cooking pan needs on top. _____

J. Heat Pump. _____

K. Using the range oven for a heater or toaster is a _____ of energy.

L. Should be flat-bottomed. _____

M. Air condition at ____.

N. Clean it after each dryer load. _____

O. Solid-state appliances use ____ energy than tube types.

P. Vent it to the outside. _____

Q. Heating and cooling system ____ should be cleaned or replaced every 30 days.

R. Fluorescent lights are at least ____ times more efficient than incandescent lights.

S. Clothes washers and dishwashers are most efficient when washing ____ loads.

T. Small appliances are ____ users of energy.

1. Clothes dryer
2. Lint Zephyr
3. 50 Percent
4. Pots and Pans
5. Insulation
6. More
7. Wasteful
8. 75 degrees
9. 3½
10. 66%
11. 65 degrees or lower
12. A high EER
13. Plastic
14. 1/32 inch
15. A tight-fitting lid
16. 200 percent heating efficiency
17. 170 degrees
18. 150 degrees
19. Lint filter
20. Wise
21. Filters
22. Full
23. Refrigerator door
24. Efficient
25. 78 degrees or higher
26. Less
27. Caulk
28. Rotors
29. Half
30. One-third

TEACHER'S ANSWER SHEET

WHAT'S YOUR E.Q.?

Statement Letter	Correct Block	
A.	5	Insulation
B.	11	68 degrees
C.	23	Refrigerator door
D.	29	Half
E.	27	Caulk
F.	18	150 degrees
G.	3	50 percent
H.	12	A high EER
I.	15	A tight-fitting lid
J.	16	200 percent heating efficiency
K.	7	Wasteful
L.	4	Pots and Pans
M.	25	78 degrees or higher
N.	19	Lint filter
O.	26	Less
P.	1	Clothes dryer
Q.	21	Filters
R.	9	3½
S.	22	Full
T.	24	Efficient

Scoring:
20, 19, 18 correct answers-Energy Conserver, First Class
17, 16, 15 correct answers-Energy Conserver, Second Class
14, 13, 12 correct answers-Energy Conserver, Third Class
11, 10, 9 correct answers--Energy Conserver, Fourth Class
Below 9-Go back to basic training

VOCABULARY - "ENERWORDS"

Ampere - A unit of measure for electric current.

Appliance - A device which does a special job, usually electric.

Barrel - A liquid measure of oil, usually crude oil, equal to 42 gallons or 306 pounds.

Bituminous Coal - Soft coal, high in volatile matter.

British Thermal Unit (BTU) - A unit of heat energy - the amount of heat necessary to raise the temperature of one pound of water one degree Fahrenheit.

Brownout - The lowering of power supplied to customers by a power company when power demand exceeds generating capacity.

Calorie - A unit of heat equal to the amount of heat necessary to raise the temperature of one kilogram of water one degree Celsius; equal to 1000 small calories.

Carbon Dioxide - A compound of carbon and oxygen formed when carbon or carbon materials are burned or used in the body.

Carbon Monoxide - A compound of carbon and oxygen formed when carbon or carbon materials are incompletely burned. When formed in automobiles, it becomes a major air pollutant.

Catalytic Converter - A device placed on the exhaust of an automobile that changes carbon monoxide and hydrocarbons, which cause air pollution, to carbon dioxide and water.

Centigrade - See Celsius.

Celsius - A temperature scale which runs from zero degrees (the temperature of melting ice) to one hundred degrees (the temperature of boiling water). Sometimes called centigrade.

Charcoal - A porous, solid residue resulting from the incomplete combustion of wood or bone.

Chemical Energy - Energy stored in the structure of atoms and molecules, which can be released by a chemical reaction.

Clean Fuel - A low sulfur fuel.

Coal - A solid organic material formed by the decomposition of plant material without air, containing 75% carbon.

Coal Gas - "Fuel gas", the gas formed when coal is partially burned to make coke. Has 1/3 the energy of natural gas.

Coal Gasification - The process which converts coal to a gas.

Coal Liquification - The process which converts coal to a liquid fuel by the addition of hydrogen.

Coal Tar - A black, gummy substance produced when coal is distilled.

Coke - A porous, solid residue resulting from the incomplete combustion of coal heated in an oven with a limited supply of air. A good fuel, more nearly pure carbon than coal.

Combustion - Burning, a chemical reaction producing heat and light and, in some cases, a flame. Usually a combination of carbon and oxygen.

Conduction - The transmission of energy directly from one substance or molecule to another.

Conserve - To keep from being lost, wasted, or damaged.

Convection - The transfer of energy by moving masses of liquid or gases.

Conversion - The process by which energy is changed from one form to another.

Cooling Tower - A structure for cooling waste water from power plants.

Cord - A measure of wood volume - a stack four feet by four feet by eight feet.

Cracking - The process of breaking down the molecular structure of heavy hydrocarbons into lighter hydrocarbons, as when gasoline is produced from crude oil.

Crude Oil - A mixture of hydrocarbons in liquid form found in underground reservoirs; the raw material from which most refined petroleum products are made.

Depletion Allowance - A tax exemption for a portion of the revenue received from depleting a natural energy resource (e.g., removing oil from a well).

Dry Steam - Steam so hot it contains no water droplets.

Ecology - The study of relationships between living things and their environment.

Efficiency - The ratio of the work or energy output to the energy input to do the work.

Electric current - A flow of charged particles, usually electrons.

Electrons - Negatively charged particles that orbit the nucleus of an atom. A chemical reaction consists of the transfer and rearrangement of electrons between atoms.

Electrostatic Precipitator - A device that removes waste particles from the exhaust of power plants by attracting them to electrically charged plates from which they can be washed away, thus preventing air pollution.

Energy - The ability to do work; to move a force a certain distance. It exists in many forms and can be converted from one form to another.

Energy Density - The energy per unit of weight in a fuel.

Energy Intensiveness - A measure of energy utilitization. For example, the number of calories used to move a passenger one mile.

Environment - Everything that is not you - and you.

Environmental Impact Statement - A predicted analysis of the impact on the environment of a projected activity. For example, the mining of coal, or offshore drilling for oil.

Fahrenheit - A temperature scale which uses 32 degrees as the melting point of ice and 212 degrees as the boiling point of water, named after its inventor.

First Law of Thermodynamics - The law of conservation of energy, which states that energy can neither be created nor destroyed.

Fission - The splitting of atoms (heavy nuclei) to release energy.

Food - The fuel used by animals, including man, to produce "body power".

Food Chain - The pathway over which any food material passes from the producing organism to consuming organisms.

Force - The power exerted on an object to produce motion or change of direction.

Fossil Fuel - A natural fuel such as coal, oil, or natural gas, formed from the fossil remains of living things.

Fuel - A substance that can be burned to produce heat.

Fusion - The joining together of atoms to release energy.

Gasoline - A fuel composed primarily of light hydrocarbons, produced by "cracking" crude oil in a refinery.

Generator - A device which produces electric energy from mechanical energy, as in a motor or water turbine.

Geothermal Energy - Heat energy within the earth which produces steam when it comes in contact with water.

Geyser - A spring from which hot water and steam shoot into the air.

Greenhouse Effect - The warming effect of the carbon dioxide in the atmosphere which allows solar radiation to reach the earth but which absorbs (and keeps in) the heat radiation from the earth.

Harness - To control so as to use the power of, as of steam.

Heat - A form of kinetic energy resulting from the movement of molecules in matter. It flows from one body to another if there is a temperature difference between them.

Heat Engine - A device which converts heat energy into mechanical energy.

Heat Pump - A device which transfers heat from one place to another by using electric or mechanical energy. It can pump warm air into a building to heat it, or out of a building to cool it.

Heat Sink - Any substance that absorbs waste heat - air, water, or space.

Heat Tax - The heat energy that is lost when energy is converted from one form to another.

Horsepower - A unit of power equal to 746 watts.

Hydrocarbons - Molecules made up of hydrogen and carbon atoms in various proportions, usually formed by living things.

Hydroelectric Plant - An electric power plant in which electricity is generated by using the energy of falling water to turn turbines.

Indirect Energy - Any form of energy used to provide goods and services, which themselves may or may not use energy.

Joule - A unit of energy or work; the amount produced by a force of one newton operating through the distance of one meter, named after its inventor.

Kerosene - A fuel used in jet engines and gas turbines, made up of a mixture of hydrocarbons by "cracking" crude oil in a refinery. Its hydrocarbons are heavier than those in gasoline or naphtha.

Kilowatt - A unit of electric power equal to 1000 watts.

Kilowatt-hour - A unit of energy or work equal to the use of one kilowatt of energy for one hour.

Kinetic Energy - The energy of motion; the ability of an object to do work because of its motion.

Laser - A device which can produce high intensity radiation by forcing the atoms or molecules in a material to radiate at the same time, rather than independently, as in a light bulb.

Light - Electromagnetic radiation which can affect the eye.

Light Water Reactor - A nuclear reactor in which water is the primary coolant or moderator.

Liquified Natural Gas (LNG) - Natural gas that has been turned to a liquid by cooling it to minus 160 degrees Celsius, thus reducing its volume and making it easier and cheaper, and probably more dangerous, to store and ship.

Machine - A device which uses energy to do work.

Mechanical Energy - A form of energy which is seen as the motion of an object.

Megawatt - A unit of power equal to 1000 kilowatts or one million watts.

Moderator - The material (water, graphite, etc.) used in a nuclear reactor to control the rate of fission.

Natural Gas - A natural mixture of hydrocarbons found in porous rocks under the earth's surface, usually in association with petroleum. It is almost pure methane.

Non-renewable - Not able to be replaced once used up, as oil.

Nuclear Energy - Atomic energy, the energy released by changes in the nucleus of an atom in a reactor.

Nucleus - The dense, positively charged core of an atom.

Off-peak Power - Power generated during a period of low demand.

Oil Shale - A sedimentary rock containing the material kerogen, which can be recovered as oil when the rock is heated at high temperatures.

Particulates - Small ash and soot particles produced in burning.

Peak Load - The maximum amount of power which a plant can produce in a given period of time.

Petrochemicals - Chemicals derived from petroleum.

Petroleum - An oily, flammable liquid mixture of hydrocarbons that may vary from almost colorless to black, found in sedimentary rocks, and providing the raw material for a host of fuels and synthetic materials.

Photosynthesis - The process by which green plants convert the radiant energy of the sun into chemical potential energy when carbon dioxide and water are converted into carbohydrates.

Photovoltaic Process - The process by which radiant energy is converted directly into electric energy.

Pollution - Contamination or fouling of land, air, or water, by chemicals, heat, noise, atomic radiation, or wastes.

Potential Energy - Stored energy, as in a battery or water behind a dam.

Power - The rate at which energy is used or work is done, measured in units of energy per unit of time (calories per second) or in units such as kilowatts or horsepower.

Primary Energy - Energy in its natural form, such as coal or oil, before its conversion to end-use forms of energy, such as heat or electricity.

Radiation - The emission of energy through matter or space.

Reserves - Portions of a resource, such as oil, which have been discovered and can be extracted by available technology.

Resource - A product of nature which people use to satisfy their needs, wants, and dreams.

Second Law of Thermodynamics - In any energy conversion, some energy passed from a useful to a less useful form, usually lost heat, or "heat tax".

Smog - An atmospheric condition in which the air is polluted by smoke, fog, sulphur and nitrous oxides. Sulphur oxides react with water to form sulphuric acid droplets, which fall as "acid rain", causing great damage to marble and limestone buildings and statues, and to bodies of water which become too acidic to support living things.

Solar Cell - A device which converts solar radiant energy directly into electric energy by the photovoltaic process.

Solar Collector - A device for collecting solar energy and converting it into heat.

Solar Energy - The electromagnetic radiation transmitted by the sun. The earth receives about 4000 trillion kilowatt-hours per day.

Synthetic Natural Gas (SNG) - A gaseous fuel manufactured from coal, containing almost pure methane.

Tar Sand - A sandy geologic deposit in which oil is found.

Temperature - The "hotness" or "coldness" of a substance.

Thermal Pollution - Any increase in air or water temperature by waste heat from electric generating plants, which causes disturbances in the ecological system of an area.

Turbine - A motor turned by a powerful stream of water or gas.

Uranium - A radioactive, metallic element used as a fuel in nuclear power plant reactors to generate electricity.

Utility - A company or organization which provides services for people, such as gas, oil, or electricity.

Volt - The electromotive force which will cause a current of one ampere to flow through a resistance of one ohm.

Watt - A metric unit of power used in electric measurements of the rate at which work is done or energy used. One watt equals one Joule of work per second.

Work - The product of a force multiplied by the distance the force is applied or the object is moved.

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SOURCES OF ENERGY INFORMATION

AND

TEACHING MATERIALS

Office of Energy and Enviromental
Education
Department of Education
Knott Building
Tallahassee, Florida 32301
(904) 488-6547

Governor's Energy Office
The Capitol
Tallahassee, Florida 32301
(904) 488-6931

American Gas Association
1515 Wilson Boulevard
Arlington, Virginia 22209
(703) 524-2000

Florida Solar Energy Center
300 State Road 401
Cape Canaveral, FL 32920
(305) 783-0300

National Coal Association
1130 - 17th Street, N.W.
Washington, D.C. 20036
(202) 628-4322

U.S. Department of Energy
Technical Information Center
Post Office Box 62
Oak Ridge, Tennessee 37830
(615) 483-8611

U.S. Department of Energy
National Energy Information Center
12th & Pennsylvania Avenue, N.W.
Room 1404
Washington, D.C. 20461
(202) 566-9255

U.S. Department of Energy
Education Programs Branch
Office of Public Affairs
20 Massachusetts Avenue, N.W.
Washington, D.C. 30545
(212) 376-4074

Local Utility Companies

County Agriculture Extension Agency

Local, state and national environmental organizations

REVIEW SHEET (4-6)

This teachers' guide, Energy and My Environment (4-6), is for your review, field testing and comments. Your evaluation of these lessons will be sincerely appreciated and your suggestions considered for inclusion in a revised publication.

Sections of Guide Taught

Grade ___ Unit ___ Lesson ___ Grade ___ Unit ___ Lesson ___

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Grade ___ Unit ___ Lesson ___ Grade ___ Unit ___ Lesson ___

Are lessons appropriate for grade level? ______________________________

____

Describe reaction of students. ______________________________

____

Is there sufficient emphasis on teaching energy facts? ______________

____

Is there sufficient emphasis on teaching values? ______________________

____

Your ideas for extending the lessons:

Grade ___ Unit ___ Lesson ___ ______________________________

____

Grade ___ Unit ___ Lesson ___ ______________________________

____

Grade ___ Unit ___ Lesson ___ ______________________________

____

Please put additional ideas on back of review sheet; include the grade, unit and lesson numbers.

Other comments and suggestions: ______________________________

____

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Reviewer: ____________________

Title: ____________________

School ____________________ County ____________________

Address: ____________________

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Phone Number: ( ) ____________________

RETURN THIS REVIEW SHEET TO:

Office of Energy and
Environmental Education
Department of Education
Knott Building
Tallahassee, Florida 32301
(904) 488-6547

or

Governor's Energy Office
The Capitol
Tallahassee, Florida 32301
(904) 488-6931

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